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SERIES II

MEMOIRS

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MESOPOTAMIAN HISTORY AND ENVIRONMENT

SERIES II

MEMOIRS V

CHANGING WATERCOURSES IN BABYLONIA

TOWARDS A RECONSTRUCTION OF THE ANCIENT ENVIRONMENT IN LOWER MESOPOTAMIA

VOLUME 1

Edited by Hermann GASCHE and Michel TANRET

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Preface

This volume presents major new interpretations on the history of watercourses in Babylonia. Building upon the pioneering work of Robert McC. Adams and a follow-up survey of the Kish area by McGuire Gibson, the Belgian Archaeological Expedition to Iraq [1] and the Oriental Institute Nippur Expedition have separately and jointly sought to detail the complex ecology of southern Iraq.

When Adams conducted his initial Akkad Survey, he had no access to air photographs, and the maps that were available, though detailed, were not at a small enough scale to include many of the ancient features. For the Kish Survey, Gibson had the use of the same quality maps, but unlike Adams he did have access to air photographs. When Adams conducted his surveys of the Uruk area and the region east of Nippur, he could at last make use of air photographs, and he could also utilize Landsat images for the first time.

Beginning in the early 1970s, both the Belgian and Oriental Institute expeditions worked closely with geomorphologists and sought to answer complex questions in historical periods through a real cooperation between archaeologists, epigraphers, and natural scientists.

From 1970 on the Belgian Expedition included two geomorphologists, Roland Paepe and Cecile Baeteman, who laid the foundations of geomorphological research in the Sippar region.

The Nippur Expedition enjoyed a collaboration for several years with Stephen Lintner, a riverine geomorphologist. Using a combination of pits, trenches, and the examination of sections of freshly cut drainage ditches, Lintner was able to build up a set of soil profiles for the Holocene in the Nippur area. One of Lintner's pits was sunk north of the site of Umm al-Ḥafrīyat to sample an ancient meander that was clearly visible on air photographs. It was especially through his work that the Expedition became aware of the highly variable and complex factors that have formed the southern Mesopotamian landscape, not the least of which has been wind erosion resulting in dune formation. Subsequently, Margaret Brandt carried out two seasons of soil sampling and field observation of traditional irrigation agriculture around Nippur, and began working out an ecological model that could be applied to ancient times.[2] Later, the Expedition had the occasional collaboration of Tony Wilkinson in examining and interpreting the soils and settlement history around Nippur. Of special importance was an inspection of

the Third River, the Main Drain being cut east of Nippur. For two days, Wilkinson and members of the Nippur Expedition inspected more than 40 kilometers of the length of this 7-meter-deep trench, encountering evidence of buried sites as well as buried watercourses, both natural and artificial. Wilkinson's joining the Oriental Institute after 1991 has meant a continuation at Chicago of environmental and settlement-pattern studies for Iraq, utilizing remote sensing techniques. While Chicago and Ghent have been carrying out different, though complementary programs of ecological research, the collaboration that was set up in the 1970s and carried out in the field, in working meetings, and in publication, has clearly benefited both programs.

Members of the Belgian Expedition, for their part, set up an International Geological Correlation Programme (River Flood and Lake Level Changes) in 1975 that was accepted by the UNESCO.[3] At the instigation of Hermann Gasche several Working Groups were initiated for the pilot area that was Iraq — the most important and most difficult one being devoted to the reconstruction of the ancient environment of lower Mesopotamia. These Working Groups, which were co-convened by Ghent and Chicago but included other universities as well, resulted in an exchange of information and ideas that is now resulting in a series of joint publications.[4]

In 1976, Gasche began a detailed stereoscopic mapping of an area comprising approximately 400 000 ha located west and south of Baghdad, between the Twin Rivers. As basic data he used available aerial photographs and corresponding small-scale maps. All visible geomorphological features (especially fossil river meanders and abandoned irrigation networks) and all visible archaeological sites were mapped. Field checks and limited archaeological surveys were also conducted. It is no exaggeration to say that Gasche's achievement was setting Babylonian historical geography on an entirely new footing.

The Belgian Expedition submitted to the Director-General of Antiquities a first Five-Year-Plan "The Northern Akkad Project" in 1984 and a continuing second in 1989. It aimed at coordinating the activities of four working groups.[3, 5] Dr. Muayyad Said Damerji agreed to the proposed program of research.

The commitment to the development of satellite image interpretation by the University of Ghent, and the purchase of SPOT and Corona images and necessary equipment, has made it possible to relate visible and enhanced traces with geomorphological information gained through laborious borings in the Tell ed-Dēr area. In this regard, Kris Verhoeven was able to bring to bear a range of technological tools that were not available to earlier researchers and could not be matched elsewhere for Iraq. He transfered Gasche's survey data to a computerized geo-corrected map system and stored all related information in a database. He also established that the archaeological sites mapped by Adams that were situated within the 400 000 ha area

mapped by Gasche had been localized with a good degree of accuracy, especially if one takes into account the fact that Adams did not have access to detailed topographical resources. This is a particularly important point, because it allowed Verhoeven to incorporate into the same map system all the sites mapped by Adams outside of the aforementioned 400 000 ha area — with minor adjustments only.

At this point, however, we were still far from a legible picture of the ancient Mesopotamian river network. We had only the basic frame: nice computerized maps with black dots representing archaeological sites, as well as related geomorphological features representing the relics of ancient natural or artificial watercourses. But few of the former and none of the latter could be identified by their ancient names. Moreover, there was a chronological dimension that was not easy to delimit.

The only way to complete this picture was to exploit and integrate the textual sources. It was because of the close cooperation between Gasche and Steven Cole — the latter having expertise in Babylonian and ancient geography and an exceptional capacity to understand and integrate data not necessarily belonging to his own field — that the completion of the first study of this volume became possible. Their interdisciplinary collaboration was fundamental to the re-identification of the watercourses. Cole is now being utilized by both Ghent and Chicago for this joint project.

The combination of images with "ground-truthing" carried out through surface inspection, archaeological excavation, soil science, and textual investigation has made it possible to present a truly innovative and persuasive map of the ancient watercourses in northern Babylonia. Similar research conducted at and around Nippur, and continued at Chicago with the same kind of satellite imagery, will be linked in future to the continuing research at Ghent. We present this book with the conviction that with it we are entering upon an improved geography for Babylonia. It must, necessarily, cause us to adjust our mental maps and read texts with a different set of possibilities and probabilities in mind.

In his contribution on the *namkarum*s Michel Tanret has undertaken a novel approach to the textual material. Focusing on a corpus limited in time to the OB period and in place to the Sippar region his aim was to extract as much geographical information as possible from the cuneiform tablets centering his research on one element of the ancient fluviatile system. Thanks to the textual, geographical, and prosopographical databases elaborated in Ghent [6] he succeeded in extracting much more information than was expected. The approximate localization of the Irnina and the Euphrates by Cole and Gasche (in this volume) allowed him to make the first geographical classification ever of the *ugārum*s, the watering districts. Within many of these he could then establish the presence of one *namkarum*. The next step, linking these findings to actual structures identifiable on areal and satellite photographs is new

too. Although a one-to-one correspondence between the *namkarum*s in the texts and in the landscape is not yet realizable, this approach opens up a whole new field of research, including cadastral reconstruction deemed impossible until now.

Denis Lacambre's, and Tom Boiy's and Kris Verhoeven's articles both deal with the location of specific canals, i.e. the Ūbil-nuhšam Canal and the Pallukkatu in Seleucid times.

Finally, the volume ends with a lengthy excursus by Kris Verhoeven who presents a geomorphologist's perspective of Lower Mesopotamia, especially the Euphrates-Tigris flood plain, and who also sets forth data he collected in 1988-1990 in the course of a geomorphological reconnaissance survey of the immediate surroundings of the archaeological sites of Tell ed-Dēr, Abū Ḥabbah (Sippar), and Abū Qubūr. His article demonstrates the disharmony that currently prevails among paleoclimatologists, whose data concerning Mesopotamia are imprecise, lack congruity, and stem from distant regions. However, the archaeological and documentary data set forth by Cole and Gasche, which can be interpreted as being in agreement with some of these climatic data, yield additional information. This information, because it stems from the Mesopotamian flood plain itself, will perhaps lead paleoclimatologists to reconsider some of their conclusions concerning the first half of the second millennium.

We are sincerely grateful to the Belgian Government, and especially to the Ministers of Scientific Policy, for having approved and subsidized since 1990 an Interuniversity Pole of Attraction "The Land of Sumer and Akkad: Reconstruction of its Environment and History."

We also express our thanks to Gene Gragg, Director of the Oriental Institute, for his interest and enthusiasm for the joint project and publications.

Léon De Meyer and McGuire Gibson

[1] Financed by the Ministers of Education.

[2] BRANDT, M.C., 1990: « Nippur, Building an Environmental Model », *JNES* 45, 67-74; also ARMSTRONG, J.A., BRANDT, M.C., 1994: « Ancient Dunes at Nippur », in GASCHE, H., TANRET, M., JANSSEN, C., DEGRAEVE, A. (Ed.), *Cinquante-deux réflexions sur le Proche-Orient ancien offertes en hommage à Léon De Meyer* (= *MHEO* 2), Leuven, 255-263.

[3] Some of the Progress Reports were published in *Tell ed-Dēr* 2 (1978) and 3 (1980).

[4] GASCHE, H., ARMSTRONG, J.A., COLE, S.W., GURZADYAN, V.G., 1998: *Dating the Fall of Babylon. A Reappraisal of Second-Millennium Chronology* (= *MHEM* 4), Ghent, Chicago, the present volume, and a forthcoming Pottery Corpus.

[5] See *Stratigraphica Archaeologica* 1 (1984) and 2 (1987), and the series *NAPR* 1 (1987) to 10 (1996).

[6] Within the framework of the Interuniversity Pole of Attraction Program IV/25.

SECOND- AND FIRST-MILLENNIUM BC RIVERS IN NORTHERN BABYLONIA[1]

by Steven W. COLE * and Hermann GASCHE **

With maps elaborated by Kris VERHOEVEN **

1. INTRODUCTION

After more than fifty years of survey investigation,[2] there is still no satisfactory picture of the network of rivers and main canals which coursed across the lower

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1 We use the term Northern Babylonia to refer to the region delimited by the modern Tigris on the east, the Euphrates on the west, approximately a line between Ramādi and Sāmarrā on the north, and a latitude not far from Babylon on the south. Two summaries of this study will be published elsewhere, one covering the area between Sippar and Babylon and the other dealing with the region between Fallūğah and Sippar. The former will appear in the proceedings of a colloquium held by the Deutsche Orient-Gesellschaft in Berlin, while the latter will appear in a Festschrift volume.

Here we wish to express our heartfelt thanks to M. Civil, who kindly helped us with the interpretation of crucial passages in Sumerian, and to J.A. Brinkman, for numerous critical comments and insightful suggestions. We also express deep gratitude to L. De Meyer and M. Tanret for freely sharing with us information gleaned from published and unpublished documents from Abū Ḥabbah and Tell ed-Dēr. Finally, we wish to address a special word of thanks to J. Renger, who invited us to speak on this topic at the meeting of the DOG in Berlin and thereby compelled us to accelerate the final stages of our research. New data have been discovered since that occasion, however, and therefore the reader should take note that there are several differences between the results that are set forth in the present study and those that will be found in the two summaries mentioned above, especially in regard to the question of the junction between the Euphrates and the Tigris at the approximate latitude of Seleucia.

* Oriental Institute of the University of Chicago.

** University of Ghent.

2 Including — in chronological order and regardless of extent of surface coverage — ADAMS 1958, ROUX 1960, JACOBSEN 1960, ADAMS 1965, JACOBSEN 1969, GIBSON 1972, ADAMS 1972, ADAMS and NISSEN 1972, ADAMS 1981, and WRIGHT 1981. Finally, the corresponding *TAVO* maps are supposed to synthesize the above-listed works. For earlier surveys with useful data, see also ANDRAE 1903, and DOUGHERTY 1927.

Virtually all the sites visited and mapped in the different surveys were dated by means of sherds collected from their surfaces. Certain inevitable pitfalls attend the use of this method: a) more than one site has yielded, upon later excavation, remains from periods which were not represented by the material on the surface; and conversely (although less frequently), prospections have encountered material on the surfaces of sites which dated to periods for which there were no related remains in the stratigraphy subsequently revealed; b) the diagnostic sherds utilized in the extensive surveys of

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Environment in Lower Mesopotamia 1
(= *MHEM* 5/1), Ghent, Chicago, 1998, 1-64.

Mesopotamian plain in antiquity. But the problems entailed in the reconstruction of this picture are immensely complicated. It is no longer adequate to draw a line between two settlements because the textual sources situate them on the same watercourse, nor is it any longer sufficient to reconstruct watercourses by connecting sites which supposedly belong to the same epoch. This innocent approach ignores one of the major elements in the picture — the geomorphology of the plain,[3] the principal components of which were set forth nearly forty years ago by BURINGH (1960).[4] Only by taking into account all the data at our disposal, which requires the close cooperation of archaeologists, geomorphologists, and philologists alike, can we hope to unravel all the complexities involved and start to build a coherent image of this system through time.

Adams and of Adams and Nissen are not always characteristic of the periods which they are supposed to represent. On this problem as it relates to the pre-Uruk and post-Hellenistic material, see the remarks of GEYER and SANLAVILLE (1996, 400). The same objection can be raised for the Old Babylonian period (as already noticed by BRINKMAN 1984, 171), while the Ur III and Isin-Larsa material, if considered together, is more reliable. Nevertheless, the objective of the present inquiry could not have been accomplished without the results of these important surveys. Without them we would not have been able to utter even the first stammering remarks about the topic at hand, the complexity of which is yet to be fully appreciated.

3 Other major factors contributing to the evolution of the Mesopotamian floodplain include climatic changes, isostatic and tectonic movements, eustatic variations in sea level, and human intervention. Climatic variations have essentially affected the dynamic of the rivers by augmenting or diminishing their discharge and sediment load (but as we will see later, this evidence cannot be used by itself to reconstruct the hydrological situation of this region). Tectonic activity has had a greater impact on the eastern side of the Gulf and on the piedmont of the Zagros, where the Arabian plate plunges beneath the Eurasian plate, than it has had on the Mesopotamian floodplain itself. For recent activity in one of the areas where these two plates collide (specifically at the 'Shaur anticline' [Ḫūzistān]), see LEES and FALCON 1952, 33-34, and SANLAVILLE 1989, 11 ; but see also LARSEN 1975, 52. Although little information is available for tectonics on the floodplain itself, it is notable that the meanders which were identified atop the fossil levee running from Abū Ḥabbah to Tell ed-Dēr as well as those found on fossil levees north and south of this line (see Maps 1 and 4) all gently sloped within the same plane, in the way that water would flow. Therefore, in this region at least, there is no direct evidence of tectonic disturbance since the formation of these meanders (nor is there evidence of subsidence ; see also GEYER and SANLAVILLE 1996, 401 for the southern part of the plain in a much earlier period). Finally, it should be pointed out that eustacy has not directly affected the northern part of the floodplain during the period with which we are concerned.

It should be noted that our summary of the geomorphology of the Mesopotamian floodplain that is presented below is written with the non-specialist in mind and therefore has been greatly simplified. For a more detailed development of the area with which we are concerned, see the contribution of K. Verhoeven in this volume.

4 For other works about the plain — often more limited in their areal and temporal coverage but generally containing relevant information on hydrography and the ancient environment — see, for example, IONIDES 1937, LEES and FALCON 1952, IONIDES 1954, VAUMAS 1955, 1958, 1962, 1964, HANSMAN 1967, PAEPE 1971, LARSEN 1975, PAEPE and BAETEMAN 1978, LARSEN and EVANS 1978, BAETEMAN 1980, PURSER *et al.* 1982, BINTLIFF and VAN ZEIST (Ed.) 1982, NIJS 1987, STOOPS 1987, DALONGEVILLE and SANLAVILLE 1987, GASCHE 1988, SANLAVILLE 1989, BRANDT 1990, WILKINSON, 1990 and 1990a, PLAZIAT and SANLAVILLE 1991, NÜTZEL 1992, ARMSTRONG and BRANDT 1994, BUTZER 1995, GEYER and SANLAVILLE 1996, and K. Verhoeven in this volume.

It is in this spirit that we intend to approach the problem of the ancient fluviatile network of lower Mesopotamia. Our initial effort has intentionally focused on the northern part of the plain during two periods of its history: the first half of the second millennium BC [5] and the first half of the first millennium (especially 750-500). The reasons for these choices are the following:

1) Thanks to precise topographical documentation and recent aerial and satellite imagery, the relief of the northern plain with all the ancient vestiges on it has now been mapped in detail, improving on the work of ADAMS (1972). It should be noted that within the frame delimiting our research, the network of the Tigris and Diyala rivers east of the modern bed of the former [6] has not yet been sufficiently investigated to allow an elucidation at the present time.[7] Nevertheless it is clear that in antiquity the Tigris, which at this latitude is lower than the Euphrates, played a less important role than the latter in irrigating the region which lies at the heart of this investigation.[8]

2) The periods chosen have both yielded abundant textual information from and about the region concerned. Also, from an archaeological perspective, the Belgian excavations at Tell ed-Dēr, Abū Ḥabbah, and Abū Qubūr-North (first half of the second millennium) and the Belgian-British excavations at Ḥabl aṣ-Ṣaḫr (Neo-Babylonian) all produced evidence relative to the paleo-environment, including flood deposits embedded in archaeological contexts and the remains of works meant to protect certain of these sites against the periodic onslaught of the same.

The reconstruction presented in this paper represents only a small part of the river network which irrigated Akkad and Sumer during the periods under consideration. Nevertheless, the region of focus is the critical zone of departure of the various branches of the Euphrates which irrigated the regions further south. We will not yet consider the intermediate Kassite and early first-millennium systems because we do not yet have

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5 All second-millennium dates cited herein refer to those proposed in *MHEM* 4 (1998). For a correction of the dates of Assyrian kings Nos. 39 to 66, see *Akkadica* 108 (1998), 1-4.

6 Especially the ancient Durul (= Turan/Turnat) and Ṭaban systems. For a recent reconstruction of the ancient Tigris channels in the area between Sāmarrā and about 30 km north of Baghdad from *c.* 8000 BC on, see WILKINSON 1990a.

7 However, we will discuss the probability that the course of the ancient Tigris corresponded more or less with the modern bed of the river from Baghdad to some distance south of Seleucia.

One should note that the alluvial fans of the Adhaim and especially the Diyala have played an important role in the evolution of the Tigris to the north, to the east, and, by inference, to the southeast of Baghdad. But the different stages in this evolution have not yet been sufficiently established to allow their full development here.

8 Because of the general west-east slope of the plain and because of the deeply incised channel of the Tigris, water-lifting devices would have been necessary (as they are today) to elevate its water onto the lands adjoining its banks.

enough solid, relevant evidence from these periods.[9] They have yielded much less documentation than the preceding and succeeding periods, and, from an archaeological point of view (to cite one problem only), the collection of Old Babylonian diagnostic sherds used by Adams in his Akkad Survey includes later material as well.[10] It is therefore difficult (if not impossible) at present to establish a distinctive picture of the river networks of these periods. Finally, we should point out that the available data allow a reconstruction of only the general frame of this network. The localization, for example, of major canals known to have been built by many of Babylonia's rulers is still a task which requires further archaeological, geomorphological, and documentary investigation. But once the natural river system has been established it will be easier to integrate the canals into the scheme that is developed.

2. The Levee System in Northern Babylonia and its Importance for the Reconstruction of the Ancient River Network

The Mesopotamian floodplain, broadly speaking, is the central part of an extensive geosyncline, the bottom of which is filled with older shelf sediments, with later erosional products having been deposited on top of them (BURINGH 1960, 38). It is primarily in the upper part of these erosional products that the fluviatile networks with which we are concerned evolved.

From north to south on the plain one can distinguish three zones:

1) the Floodplain (from Sāmarrā/Ramādi to Amara/Nāṣirīyah), the northern part of which (roughly from Sāmarrā/Ramādi to Kūt/Ḥilla) is covered in large measure by the present investigation,[11]

2) the Marsh Zone (from Amara/Nāṣirīyah to Baṣrah), and

3) the Estuarian Zone (from Baṣrah to the shore of the Gulf), with zones 2 and 3 being confined between the vast gravel cone of the Wādī Bāṭin on the southwest and the fluviatile deposits of the Karūn and Kerḫa on the northeast.

To the west of the plain lies the Western Plateau, which consists mainly of different kinds of limestone formed on the old shelf, the thickness of these layers being

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9 Such evidence might eventually explain the dramatic differences which we can see between the system of the first half of the second millennium BC and the one which is in evidence after 750 BC.

10 This is also why on Map 8 we do not show the sites whose first occupation is dated by Adams (1972) to the Old Babylonian period.

11 The northern part of this zone is characterized by a more meandering river system than the southern part (that is, from Kūt/Ḥilla to Amara/Nāṣirīyah). For a fuller treatment of this topic, see K. Verhoeven in this volume. See also SANLAVILLE 1989, 7-10 (but the reader should note that his 'Alluvial Plain' and 'Deltaic Plain' together correspond to our 'Floodplain').

up to eight kilometers. The Ğazīrah, which is also higher than the plain (apart from the central Ṯarṯār depression), forms the northern border, and contrary to its meaning 'island,' it encompasses vestiges of an old inland sea in which mainly gypsum has been deposited (BURINGH 1960, 37). To the east, finally, the plain abuts the large irrigation fan of the Diyala and, to the southeast of it, the fan deposits of the Piedmont.

Near Fallūğah the Euphrates finally emerges from its valley which it has incised between the Western Plateau and the Ğazīrah.[12] A river's natural tendency when emerging from such a valley is to spread out radially in multiple branches over the open plain which lies before it. This is probably what occurred after each Ice Age glaciation when the Euphrates discharged massive amounts of gravelly sediments in an alluvial cone fanning out from the end of its valley. Remnants of this topographical feature include the large Fallūğah Terrace and perhaps also the smaller outcrops just to the south and southeast of it.[13] Despite the fact that the Euphrates no longer discharges its flow in a radial pattern in this region today, the geomorphological features which reflect the ancient drainage pattern show that this distribution system existed in historical times (see Map 2).

The Levee System Between the Twin Rivers in Northern Babylonia (Map 1)

All floodplains exhibit the same dynamics. Provided that the velocity of a river is sufficient, it will flow forward along a line that is more or less straight. But when it can no longer surmount the many and various obstacles opposing its movement, it skirts the barriers, and thus forms meanders. Its course then lengthens as its slope diminishes. The current then no longer passes along the center line of the channel but strikes instead against the concave bank of each curve and underwashes it. The river deposits its sediments on the opposite bank, where the velocity is weaker. Meanders therefore shift constantly.[14] Often two neighboring loops end up joining each other, whereupon the water rushes through the breach, and the old bed, now abandoned, becomes a dead channel. The large loop south of Seleucia that was abandoned by the Tigris clearly illustrates this phenomenon (see Fig. 1).

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12 Its alluvium actually begins about 80 km upstream, south of Hīt, where the gradient of its flow is already very slight, falling only about ten centimeters per kilometer. According to BURINGH (1960, 49, Fig. 19), the course of the Euphrates through Iraq exhibits the following gradients: 30 cm/km between ʿĀna and Hīt; approximately 10 cm/km between Hīt and Šanafīyah; 3 cm/km between Šanafīyah and Nāṣirīyah; and finally 1.5 cm/km between Nāṣirīyah and the Gulf.

13 The Iskandarīyah Terrace, located south of Sippar, could also be a remnant of such a feature but this has not yet been definitively established. All these features, including the Ğazīrah, are shown in gray on our maps.

14 For a schematic illustration of the way in which meanders form and shift, see JUDSON and KAUFFMAN 1990, 294, Fig. 13.33.

Of more pertinent interest here, however, are the long, slightly swelling features which mark the relief throughout the plain (see Maps 1 and 2). They are scarcely visible to the naked eye (if visible at all), because they are several kilometers in width and rarely exceed four meters in height. They traverse the plain in different directions, and certain of them exhibit on their summits large crescent-shaped features, which when viewed from above are characterized by concentric, bending stripes (Fig. 2). BAETEMAN (1980, 18-20) made augerings in the one southeast of Tell ed-Dēr and determined that it was a point-bar deposit which had formed on the inside (or convex side) of a meander. Therefore, these reliefs with fossil river traces on their summits are levees formed by ancient branches of the Euphrates.[15]

The process by which these structures are formed is well known and can be summarized in the following manner. With each inundation [16] the terrain close to the channel receives most of the sediment load, with the rest being transported to more distant areas. The perennial rhythm of seasonal inundations occasions a continuous heightening of the river's approaches, with the water flowing more and more on its own alluvial material. Finally the river channel is elevated well above the plain, with basins forming progressively on either side. The practice of irrigation along fluviatile arteries — where the most favorable soils for agriculture are encountered — has also significantly contributed to their construction.[17]

Whatever the rhythm or causes of this heightening may be, the river ends up flowing some meters above the level of the plain. During a particularly violent flood,

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15 Only those meanders for which adequate documentation is available can be mapped. This is true for the levees located just north and south of Abū Ḥabbah. But not all the levees exhibit paleo-fluviatile traces, either because they were not formed by natural river channels or the traces have been buried by sediments from subsequent intensive irrigation activity. This situation alone demonstrates the complexity involved in reconstructing the old river system of Babylonia.
These meanders are evidently connected with a course from the most recent phase of the fluvial channel which formed them.

16 Before the advent of modern projects to control flood discharge, such inundations could occur "almost every 3 or 4 years" (BURINGH 1960, 52). VAUMAS (1962, 241) noted that the Tigris burst its dikes ten times upstream from Baghdad and eight times downstream between 1944 and 1954. He also remarked on the consequences of large floods, such as that of 1954, when the magnitude of the river's discharge was estimated to have been more than five times greater than that under average flood conditions (*ibid.*, 240-242). It was only after 1956 that Baghdad and the rest of the plain was theoretically shielded from this scourge, because from that time forth the floodwaters of the Tigris could be diverted into the Wādī Ṯarṯar depression and those of the Euphrates into the depressions of Ḥabbānīyah and Abū Dibbīs.

17 The silt burden of the Twin Rivers, of which a large portion is deposited on the plain by irrigation, is impressive (see, for example, LEES and FALCON 1952, 29, citing M.G. Ionides; SCHILSTRA 1962). The rate of sedimentation is also appreciable along the secondary canals that tapped their water from the main channel (see Figs. 3 and 4, which illustrate the impressive size that secondary canals can exhibit). These appendages of the main levees are very visible on our Map 4, especially along the canals in the area of Tell ed-Dēr (note also their characteristic 'wheat-ear' arrangement).

the river can abandon its channel and recommence, now in a basin, the process which we have just described. But this phenomenon must have occurred only rarely in the part of the plain with which we are concerned, because the main levees here were built up incrementally over millennia.[18]

The above-described process applies to all levees reconnoitered in the project area. In general, one can readily distinguish between levees constructed by natural watercourses and those built up by the more important irrigation canals. The following two sectors, however, are exceptions:

1) the region just south and east of the Fallūğah Terrace, where traces of older river channels are mostly buried under sediments deposited in the course of the intense irrigation practiced here after the foundation of Baghdad by the Abbasids, and

2) the 'valley' between the Fallūğah Terrace and the Ğazīrah, where the modern topography largely obscures the older relief (perhaps because eolian deposits from the Ğazīrah and the Fallūğah Terrace have played a major role here, but the area still requires detailed geomorphological and archaeological investigation).

3. Archaeological and Textual Evidence for Floods

The First Half of the Second Millennium

In one of the deeper levels of Chantier A at Tell ed-Dēr,[19] a deposit in which water played a dominant role abutted against a possible protective work. Because only a small surface of this structure was exposed, and because its size cannot be compared with that of the dike surrounding the site, it is mentioned here only to note its existence. However, there is other, more certain, evidence of serious flooding during the first half of the second millennium BC, especially from the reign of Hammurabi on. This evidence will now be summarized.

Hammurabi encountered serious floods during his reign. The formula for his 43rd year (1654 BC) informs us that he heaped up a great volume of earth around Sippar (Abū Ḥabbah).[20] His work can be identified with the lower elements of the massive embankment that protects the site. Excavations revealed this embankment to be

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[18] For example, the levee between Abū Ḥabbah and Tell ed-Dēr grew about 1.5 m during approximately the third millennium alone (Gasche 1988, 42).

[19] Phase IIId (Ur III); cf. Gasche 1984, 7-9, 16.

[20] Ungnad 1938, 182; Horsnell 1974, 276-280. The building of this structure was also commemorated in an inscription (see Frayne 1990, 348-349).

a dike, the construction of which commenced around the reign of the great king.[21] Shortly thereafter, but already during the reign of his son, a dike was also constructed around the neighboring city of Sippar-Amnānum (Tell ed-Dēr).[22] As at Sippar, the oldest elements of this construction rested directly atop alluvial deposits, thus illustrating the reason for its inception and completion. Also at Tell ed-Dēr, but around 1580, a flood destroyed part of the house of Lamassāni, the daughter of a priest of Annunītum.[23] This flood was preceded some one to four decades earlier by an inundation during the reign of Abi-ešuḫ requiring the mobilization of all the landholders in the Sippar region to reinforce the banks of the Irnina and the Purattum, because, the king's order declared, floodwaters had risen to the level of the quay-walls.[24]

Abū Qubūr-North also revealed significant fluviatile deposits, between probable Ur III remains and those of Isin-Larsa date, as well as above the installations dating to this latter time.[25] At Nippur, a deposit showing an internal structure similar to that of the dikes around Tell ed-Dēr and Abū Ḥabbah was uncovered above the Ur III city-wall but below remains of the Kassite period.[26]

Although little importance has been attached to one of the trenches opened by the Germans through the city-wall of Uruk, it nevertheless merits reflection. The published section of it [27] shows an accumulation of earthen layers more than 5 m thick, the two slopes of which are symmetrically eroded. According to the excavator, this earthen

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21 GASCHE and PAEPE 1980, 51 : its attribution to the "second half of the Paleo-Babylonian Period for the D(ike) 2 system" was made on the basis of the archaeological evidence alone.

22 A letter from Samsuiluna informs us that a traditional enceinte of brick existed at Sippar-Amnānum during his reign (FRANKENA 1966, No. 77). We have proposed elsewhere to identify this enceinte with the wall that was uncovered beneath the peripheral dike, because the nature of its construction and the date of the archaeological finds support this hypothesis (GASCHE 1989, 140-141). The sediments encountered in the course of the excavations show that this structure was destroyed by inundations (PAEPE *et al.* 1978, 15, 22, and Plan 1) and that it was replaced first by a relatively modest earthwork (*ibid.*, Plan 1, D 20), and then by at least three successive earthworks of massive proportions (D 21, 22, and 23, with a width of up to 50 m). Each of these structures — including the first — exhibited all the characteristics of a dike. The same succession of features can be reconstructed at Sippar, where SCHEIL (1902, 13) found a mud-brick structure below the presently visible peripheral embankment (see also DE MEYER and GASCHE 1980, 26).

23 JANSSEN *et al.* 1994 ; see in particular pp. 110-111 for an emendation of the chronostratigraphy, which initially had been interpreted differently (GASCHE 1989, 7). The house of Lamassāni was located on the northeast periphery of the town, the only side not entirely protected by the peripheral dike, because the accumulation of occupational debris upon which the house was built must have been judged to be sufficiently high to offer protection against floods. This shows that the inundation which ravaged part of the house of Lamassāni must have been one of unusual magnitude.

24 FRANKENA 1966, No. 70.

25 DE MEYER and GASCHE 1986, 10-23.

26 GIBSON *et al.* 1983, 177.

27 HALLER 1936, Pl. 12c.

body sits on top of remains dating to the Isin-Larsa period, meaning that the earthen layers belong to a later period. If that period should eventually prove to be Old Babylonian, then the earthen layers in question would be roughly contemporaneous with the dikes around Abū Ḥabbah and Tell ed-Dēr. Even if definitive conclusions about the function and date of this structure are precluded, it certainly merits closer scrutiny, because it presents the very same characteristics as the dikes identified around the two Sippars.[28]

There is also evidence of dike-building activity at Mari [29] and of serious flooding in the town and its surrounding region. Some twenty-five undated letters to Zimri-Līm, Hammurabi's contemporary, report heavy rains and high floods in both the Euphrates and its largest tributary, the Ḫabūr, with all the attending damage one would expect from such events. They report, for example, that the dikes of the region were reinforced from top-to-bottom with bitumen in anticipation that the rivers would flood after two heavy rains,[30] that the wadis near Mari filled with floodwaters and inundated fields near the palace,[31] and that other wadi floods caused breaks in barrages built of stone, damaged a bridge, and destroyed canal works, necessitating a levy of more than 2000 men to repair them.[32] They also mention a high flood in the Ḫabūr that prompted an urgent call for reinforcements at Terqa to attend to the barrages, over the top of which water was said to have been continually pouring.[33] They report that the Ḫabūr rose to a height of 2 m above flood stage, and that after it had broken through the dikes and inundated the surrounding countryside, the entire labor force had to be engaged to shore up the banks, and still more men were needed.[34] Finally, we learn that a flood of the Ḫabūr caused 21 m of the outer wall of the citadel of Saggarātum to collapse, necessitating yet another appeal for able-bodied men, this time to repair damage to the palaces at Saggarātum and Dūr-Yaḫdun-Līm.[35] These troubles may have begun before Zimri-Līm ascended the throne of Mari, as evidenced by the name given to one of his first years of reign: 'The year in which Zimri-Līm put in order the bank of the Euphrates.'[36]

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[28] One should note, however, that this is the only sector of Uruk's enceinte which has revealed this type of structure. On the other hand, not all the relevant sectors were investigated, nor did a protective dike necessarily have to follow the line of the ancient city-wall, especially one which delimited an area over five times greater than that which the dike of Sippar enclosed.

[29] For the archaeological evidence, see MARGUERON 1998, 3.

[30] DOSSIN *et al.* 1964, Nos. 27-28.

[31] KUPPER 1954, Nos. 2-3.

[32] KUPPER 1954, Nos. 1, 4-5, and 7.

[33] KUPPER 1950, Nos. 2 and 7.

[34] BIROT 1974, No. 13; see also KUPPER 1954, Nos. 8-9.

[35] JEAN 1950, No. 101.

[36] ZL 1' = *šanat Zimri-Līm aḫ Purattim uštēšeru* (DOSSIN 1950a, 58 No. 29). On the order of Zimri-Līm's

The evidence presented above invites the conclusion that the first half of the second millennium was characterized by higher than average precipitation and runoff in the catchment of the Twin Rivers. To confuse the picture, however, several letters from this period show that important watercourses in both Babylonia and the Middle Euphrates were choked by silt and vegetation, a strong indication that the water level in these channels was low and their flow sluggish. Hammurabi, for example, sent instructions to Sîn-iddinam to remove the silt and vegetation from the bed of the Euphrates between Larsa and Ur and to put its channel in order.[37] In another letter from the king, this time to Šamaš-ḫāzir, it is even implied that the channel between these cities was dry on at least one occasion.[38] It is also reported that water could not pass along the channel through Uruk because it had not been dredged.[39] Finally, a letter from Mari indicates that reed beds were clogging one of the main canals of the region and they therefore had to be burned.[40]

All this evidence considered together presents an apparently contradictory picture of the hydrological situation in Mesopotamia. On the one hand we have too much water, and on the other not enough.

The path to resolution can be found in the implications of paleoclimatic data from Lake Van and the Gulf, even though these bodies of water are far removed from the region with which we are concerned. Evidence from annual layers of sediments in Lake Van, the climate of which is thought to be representative of the Tigris-Euphrates catchment area, allowed BUTZER (1995) to reconstruct flood levels in this system. He used this proxy data[41] to demonstrate "low water volumes" from just before 3000 to about 1500 BC.[42] A similar conclusion had already been reached by NÜTZEL (1975), who argued for moderate discharge in this system for the period between 3000 and 500

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year names, see, e.g., CHARPIN and DURAND 1985. In general, Mari specialists understand *šutēšurum* in this context to have a political connotation.

37 FRANKENA 1966, No. 4.

38 KRAUS 1968, No. 80.

39 FRANKENA 1966, No. 5.

40 KUPPER 1950, No. 76.

41 After KAY and JOHNSON 1981.
"The most sensitive variable is the changing dilution or concentration of the oxygen isotope ^{18}O, which here appears to reflect on lake volume and hence trends in regional rainfall" (BUTZER 1995, 136).

42 BUTZER 1995, 133, Fig. 2, 136. In fact, this is the longest period of a nearly permanent low water level between 4000 BC and the present.
A word of caution is in order here. For Mesopotamia, paleoclimatological results are rarely consistent with one another, and, consequently, it is practically impossible to choose one set of data in preference to another. The two data sets we cite have been chosen because they allow partially overlapping interpretations, and they can be harmonized with the archaeological and documentary evidence that we have assembled. See also the contribution of K. Verhoeven in this volume.

BC based on the relatively high content of organic material in the sediments that form the floor of the Gulf where Iranian rivers flow into it from the southern Zagros.[43]

Turning back then to the hydrological situation in Mesopotamia, it is possible to bring the entire set of data into agreement. Low water in a river leads to the siltation of its bed and the constriction of its channel. When this happens, the river can no longer flow with enough force to scour its bed until the arrival of the annual spring runoff, when the combination of a filled-up bed and a sudden increase in water volume can spell disaster. It is because each of these circumstances was present that damaging floods, sluggish channels, and dike-building activities are all attested within the same period of time.

Evidence for Flood Control Systems

A palliative but certainly inadequate technique of flood control that was practiced even until recently involved voluntarily breaching a river's dikes or opening canals pointing toward basins when floodwaters rose to a level sufficient to sound the alarm. The water would then rush into the lower areas in a direction that was more or less controlled, diminishing the potential for disaster if the flood was not of exceptional magnitude. A letter from Hammurabi to Šamaš-ḫāzir shows that the technique was used in his time. The king wrote : "The river flows strongly here. The water is high. Open canals pointing in the direction of the marshes and fill the morass around Larsa." [44]

Samsuiluna conceived a plan to remedy, once and for all, the plague of seasonal flooding. A curious date formula commemorating his 26th year of reign records that he "made a cleft 11 m deep [45] in the stone barrier of the great mountain of Amurru ; he dug the tail of the canal 'Samsuiluna-is-the-Source-of-Abundance' from (or in) a swamp, connecting it with..., which caused a wide expanse of land to appear, thus extending the cultivated area of Babylon and establishing..." [46]

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43 The investigation of these sediments was conducted in 1964-65 by a team aboard the German research ship 'Meteor.' The relatively high proportion of organic material in these sediments points to both a moderate amount of water in their channels and a moderate amount of precipitation in their catchment areas between 3000 and 500 BC. It also points to a relatively dry climate over this period.

On the basis of these same results, KAY and JOHNSON (1981, 259) conclude that "The southern Zagros experienced a change from humid to arid climate *c.* 5900 BP, and remained arid until *c.* 3000 BP." Despite the fact that Kay and Johnson show little enthusiasm for Nützel's conclusions, the 'arid periods' of both Nützel and Kay and Johnson include the first half of the second millennium BC, the period with which we are presently dealing.

44 KRAUS 1968, No. 85. See also VAN SOLDT 1994, No. 5 (Hammurabi to Sîn-iddinam of Larsa).

45 1 1/2 nindan 4 kùš (= 22 cubits).

46 UNGNAD 1938, 184 No. 171 (numbered '27' instead of '26'). The full text reads : mu sa-am-su-i-lu-na lugal-e ḫur-sag-gal kur.mar-tu.ki-a 1-1/2 nindan 4 kùš bùru-da-bi na$_4$ sag-gi-a-

The only place where Samsuiluna's project could have been realized[47] is the stone barrier which separates the Ḥabbānīyah and Abū Dibbīs depressions (see Maps 1 and 8).[48] According to the topography, the depth of the cut needed to connect the two depressions is about 11 m, if the lake of Ḥabbānīyah is filled to an elevation of approximately 45 m. This ambitious project, which was both perfectly realistic and technically achievable for the time,[49] would have allowed the Abū Dibbīs depression to receive more than four billion m^3 of water, of which, however, three billion would have evaporated each year.[50] Such a scheme, if completed, would have accomplished the following objectives:

1) it would have prevented Euphrates floods in Babylonia (although the Tigris would have remained a problem for the eastern part of the floodplain[51]); and

2) it would have created a substantial reservoir for the irrigation of the plain between Babylon and the edge of the Western Plateau during the drier months of the year (in effect, as soon as the water of Abū Dibbīs reached an elevation of about 27 m it could have been utilized to irrigate the above-mentioned plain, because northwest of Karbalā' there is a depression at this elevation on the edge of the Western Plateau [see Maps 1 and 8]).

Unfortunately we were unable to establish if there was any trace of an ancient cut of the ridge before the modern one (the so-called Muğarrah Canal) was made, nor is

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ba nam-mi-ni-in-dar-ra íd.*sa-am-su-i-lu-na-na-ga-ab-nu-úḫ-ši* kun-bi šà ambar-ta mi-ni-bal-e mùš-a-ka ša-mu-un-lá-a ki-in-du dagal-la-ta im-ta-an-è-a gán-zi ká-dingir-ra.ki-ka šu mi-ni-in-peš-peš-a x x x x (x) mi-ni-in-gar-gar-ra (a composite text from the most complete sources: POEBEL 1912, No. 100 iv 29-39; ÇIĞ, KIZILYAY, and KRAUS 1952, No. 103 vi 28-36; POEBEL 1909, No. 59 [envelope] 7-11; see HORSNELL 1974, 399-403). We thank M. Civil for help with the interpretation of this formula.

47 It is clear that 'mountain of Amurru' in this context refers to hills in the desert directly west of Babylonia proper rather than in Syria (e.g. KUPPER 1957, 178-179), since the date formula explicitly states that the cultivated area of Babylon was the target of his intended benefaction. Just west of the lake of Abū Dibbīs there are summits rising up to 100 m above the level of the Euphrates.

48 As WILLCOCKS (1917, 15) has already shown, the first point at which the water of the Euphrates can leave the valley is near Ramādi, where three openings in the desert (see our Map 1) could allow the river in flood to be easily directed into the Ḥabbānīyah lake. But the capacity of the latter is not sufficient to receive the outflow of several severe floods in succession, which is why he recommended connecting it with the Abū Dibbīs depression to the south. This project was finally accomplished and has been integrated recently into a new, even more sophisticated water-regulating system.

49 To be completely effective, this project would have necessitated the construction of a small barrage-regulator at the outlet of the Ḥabbānīyah lake, a task which would have confronted the builders of that age with no particular technical difficulties.

50 WILLCOCKS 1917, 15.

51 It must be recalled here that the terrain which is susceptible to Tigris inundations represents a surface area that is appreciably less important than that which can be affected by floods of the Euphrates system. See, for example, the map published by BURINGH (1960, Fig. 20), who shows the extent of the terrain inundated by the Tigris as a consequence of the huge flood of 1954.

there any mention of such a cut in the report of Willcocks.[52] One wonders therefore if Samsuiluna in fact realized his objective or if he abandoned the project after having completed only an initial phase of the work.[53]

The First Half of the First Millennium

Evidence uncovered during the excavations at Ḥabl aṣ-Ṣaḫr, on the so-called Wall of Media,[54] permit us to conclude that flow in the Euphrates channel which ran parallel to the wall was artificially controlled in the Neo-Babylonian period and that Nebuchadnezzar II could have utilized a portion of its water to maintain a marshy area in the basin located to the north of this advance defense of Babylon.[55] The existence of a large, permanent morass in the region of Borsippa[56] suggests that the bulk of Euphrates flow was now coursing along more westerly channels in the system. High water seems to have been a problem during this period, as evidenced by Nebuchadnezzar's statement that he had to rebuild the palace at Babylon because high

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52 WILLCOCKS 1917, 15-16, and Pl. 26; see however the allusion on p. 15 to a "thick belt of Euphrates shells at R.L. 25.00 metres showing that in ancient times it was filled with escape water from the Euphrates." On the general map found on Pl. 1, Willcocks indicates a rather precise course for this outflow, which, however, is untenable from a topographical point of view. There is also no trace of it in the presently available topographical and aerial documentation.
It cannot be precluded that Samsuiluna constructed an underground connection between the two depressions — a qanat-like structure for example — but no such remains were noticed by Willcocks, either because they were no longer visible or because he did not specifically look for them. The wording of year formula 26 does not exclude such an interpretation.

53 In light of the date formula for Samsuiluna's 26th year, that of his 3rd year would seem to commemorate the first phase of this project — the construction of an escape canal from the right bank of the Euphrates near Ramādi into the Ḥabbānīyah depression. This formula records that Samsuiluna "dug the canal 'Samsuiluna(-the-King)-is-the-Source-of-Abundance' in a territory neglected since days of yore, which caused an expansive cultivated area to appear in the middle of the country..." (revised translation of HORSNELL 1974, 294-300). This canal could have used one of the three openings in the desert which allow the water of the Euphrates to be directed into the Ḥabbānīyah depression (see WILLCOCKS 1917, Pl. 26; and for a simplified drawing, see our Map 1). In fact, it is even possible that one of the branches of the old Aziziya Canal system (which passed through the same opening as the much more recent escape shown on our Maps 1 and 8) was a remote echo of Samsuiluna's work. For a detailed map of this area, see WILLCOCKS 1917, Pl. 26, and MOBERLY 1927, Map 34. (We thank J. Reade for bringing the last-mentioned item to our attention.)

54 BLACK *et al.* 1987; GASCHE 1989a.
We will see below that during the first half of the second millennium BC — within the geographical frame of the present project — the Tigris very likely followed much the same course as it does today. Because there is no evidence to indicate that its situation was any different in the Neo-Babylonian period, we will have to reconsider the western extension of the Wall of Media in order to harmonize its length as observed in the field with the length attested in the written sources (see BLACK *et al.* 1987, 15-21). But this is not a concern of the present study, and neither are the implications for the location of Opis/Akšak.

55 GASCHE 1988, 43.

56 COLE 1994.

water had weakened its mud-brick foundations.[57] Moreover, he appears to have elevated the whole center of the city by up to five meters.[58]

4. MAJOR WATERCOURSES IN THE FIRST HALF OF THE SECOND MILLENNIUM

We noted above that the main levees were built up over very long periods of time by the branching network of the Euphrates. As soon as this process commenced, the levee network became the abiding conduit of the water supply. Even if a river shifted its channel for some reason, the relief remained, and man was compelled either to refurbish the old bed or to replace it by a canal which could then take advantage of the existing topography, of which the levee system was a permanent component.[59] In the latter case, the replacement canal did not necessarily have to run along the very top of its levee, but rather could have flowed at some distance from its axis, depending primarily upon the level of the water in the river from which the canal tapped its water. Over a long period of time such a displacement from the central axis would have occasioned a widening of that length of the levee along which it coursed, which is why certain fossil meanders and alignments of sites are found at some distance from levee summits proper.

Map 1 covers the region between Ramādi and Babylon and shows the levee system with its characteristic micro-relief. Map 2 shows the drainage pattern of this area. Map 3 shows the same relief as Maps 1 and 2, but to it have been added all the archaeological sites actually known, regardless of their period of occupation. Their spatial distribution shows that a great number lie directly on the center part of the main levees while most of the others, located at some distance, are on appendages of the main levees (like those radiating from the Abū Ḥabbah/Tell ed-Dēr levee on Map 4). The general distribution pattern demonstrates the perenniality of the basic system, especially in light of the fact that all periods of occupation from Ubaid to Islamic are covered.

Now that we have established the physical picture of the river network, our next task will be to examine the textual information to determine if it allows us to put labels on the various branches. Administrative documents, building inscriptions, and year names all provide information about the river network during the periods in question, but in our opinion the everyday documents supply the most pertinent and realistic

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57 LANGDON 1912, 136 vii 36-52.

58 See, for example, KOLDEWEY 1990, 36, 74-76, 79-80, 118-121, 150, and 181-182.

59 The scheme proposed by WILLCOCKS (1917) at the beginning of the century to recultivate the Mesopotamian plain faithfully reutilized the same levees for the big distribution canals. The same is true of projects implemented after the 1950s.

evidence. They show that during the first half of the second millennium the Euphrates still split near Fallūǧah into several major branches which then coursed across the floodplain in a meandering pattern not unlike that shown on many Arabic, Persian, and other medieval maps.[60]

The Branch Departing the Euphrates above Fallūǧah (Map 8)

A very large fossil meander that was reconnoitered in 1977 some 8 km north of the modern Saklawīyah Canal[61] indicates that a major watercourse departed from the left bank of the Euphrates above Fallūǧah and flowed along the present southern edge of the Ǧazīrah in the direction of the large depression north of ʿAqar Qūf,[62] which, for topographical reasons, can only drain via a connection to the Tigris.[63] Although this waterway cannot yet be dated with any degree of precision, it is almost certain that it gradually migrated southward until it finally took the course now followed by the Saklawīyah, the sinuosity of which shows that it was originally a natural channel. Rāpiqum, a town that was controlled at various times by Dādūša, Šamšī-Adad I,

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60 See the maps assembled by JANSSEN (1995, 220-223).

A Euphrates which was divided into several branches was still a characteristic feature of 17th- and 18th-century documents, including La Ruë's "Assyria Vetvs..." (Fig. 6), which was first published in 1651 as an addition to his Atlas "La Terre Sainte en six cartes géographiques" (see LAOR 1986, No. 421). It is obvious that this map does not reflect the geographical reality of the mid-17th century but rather a historical situation reconstructed from older documents (for a more realistic, perhaps contemporaneous, geographical view of lower Mesopotamia at this time, see the map of Petrus Plancius, drawn in 1594, and recopied by P. van den Keere in 1607 [BRICKER and TOOLEY 1971, 120-121]). In this respect, one should note that Latin editions of Ptolemy's second-century AD works, illustrated with maps, had been printed by the end of the 1470s (DILKE 1985, 162), and there was apparently great demand for them. The theory that they were repeated copies of documents from the second century AD still has its devotees today, but it also has its detractors; in fact, we are not sure if Ptolemy drew more than his World Map (DILKE 1985, 154). But whatever the truth is about his 'Regional Maps,' the documents attributed to him and printed from the 1470s on had to be reproduced from older exemplars. Also, we can observe that the branches of the Euphrates shown on his "Qvarta Asiae..." (Fig. 5) are similar to those shown on La Ruë's map (Fig. 6). They recall to some extent the general pattern of the Euphrates network we are proposing for the second and first millennia BC (Maps 8 and 9). However, most of La Ruë's hydronyms, as well as most of his and Ptolemy's toponyms, show convincingly that we are dealing with identifications which are based on conjectural data. On the other hand, one should note that the junction between the Euphrates and the Tigris shown on both maps — and on other 17th- and 18th-century maps — is in agreement with Herodotus' (I 193) statement that a 'stream' (ποταμός) connected the Twin Rivers, and it also reflects the probable junction between the Main Branch of the Purattum and the Tigris during at least the second millennium BC (see below).

61 See Map 1 for the localization of the only meander actually known in this region.

62 GASCHE 1985, 582, and our Maps 8 and 9.

63 See the Maps for a remnant of this outlet. Its lower stretch was built by Daud Pasha in order to protect contemporary Baghdad from the danger of inundations (CHESNEY 1969, 54). Before the time of Daud Pasha, the outlet connected with the Tigris slightly upstream of the capital as it existed in his day.

Hammurabi, and Ibâl-pī-El II,[64] was undoubtedly located near the point of its departure.[65] The name of this channel cannot yet be identified in the third- and early-second-millennium textual record, perhaps due to the dearth of documentation from the region through which it passed. But it may have been the route followed by five hundred boats of the king of Aleppo which are said to have docked in Diniktum,[66] if in fact they did not follow the Irnina branch of the river, which we situate north of Sippar rather than south of it.

Irnina and Zubi (Maps 5 to 8)

All assertions that the Irnina ran south of Sippar are based ultimately on the conjectures of JACOBSEN (1960, 176, and n. 4), who suggested that this branch departed from the left bank of the Euphrates at Sippar, flowed southeast and south over Kutha, passed south of Jemdet Nasr, and then joined the Zubi east of that site. While the Irnina is most definitely associated with the region of Sippar in Old Babylonian documents from Abū Ḥabbah and Tell ed-Dēr, there is not a single bit of evidence to connect it with Kutha or its region.[67] Moreover, Jacobsen suggested that the course of the Zubi followed a line of tells, identified by Adams and Crawford, which began at Abū Qubūr (north-northwest of Sippar) and passed over Tell ed-Dēr (northeast of Sippar) and then to the east of Jemdet Nasr (east-southeast of Kutha), where it joined the Irnina.[68] But this is a topographical impossibility, since the Zubi would have had to flow up and over both the levee of Tell ed-Dēr and the levee just south of Maḥmūdīyah if it had followed such a course (see our maps). It is necessary, therefore, to review the evidence once more.

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64 ANBAR 1975, 2-7.

65 As correctly observed by FORRER (1921, 13), contra, among others, BRINKMAN 1968, 127, n. 748. A good candidate for Rāpiqum would be Tell Anbār, which is situated on the left bank of the present Euphrates, just northwest of Fallūğah and not far south of the present 'mouth' of the Saklawīyah canal. This large and high tell, which has not yet been excavated or extensively surveyed, was first described by WARD (1886, 24-25), who, however, suggested that it should be identified with Sippar-Amnānum. According to DAMERGI (1986, 11), Tell Anbār was occupied during the time of the First Dynasty of Babylon, which roughly coincides with the period of the first attestations of Rāpiqum (going back to Ur III; see EDZARD and FARBER 1974, 157). However, the most significant remains at this imposing site belong to periods that are much more recent: Parthian/Sassanian and Islamic up to the 13th century AD.

66 DOSSIN 1956, 67: 22-23. Diniktum was situated in the lower Diyala region, probably on the Tigris itself (*ibid.*, 67). See also NASHEF (1982, 82-83) for a possible identification with Tell Muḥammad, which lies a few hundred meters south of Tell Harmal. Tell Muḥammad, however, has also been suggested as a plausible candidate for Agade (WALL-ROMANA 1990). For an early Kassite year formula mentioning excavation work on the ÍD.*Diniktum*.KI, which may well refer to a canal between the Durul (= Turan/Turnat) or Ṭaban rivers and the Tigris, see BRINKMAN 1976, 146-147 Ka.2.1 and text 18.

67 Compare GIBSON 1972, 5; CARROUÉ 1991, 130.

68 JACOBSEN 1960, 176.

We know that the Irnina flowed into the Zubi above Puš.[69] This town, which is associated with Sippar in Ur III and Old Babylonian texts,[70] was certainly near (if not identical with) Dūr-Puš, in the hinterland of which there was a field bordering on both the Tigris and the Purattum.[71] Now, as we will see below, the Purattum flowed in an easterly direction from Sippar to Sippar-Amnānum (Tell ed-Dēr) and came very close to the modern bed of the Tigris after turning southeast (see Map 8). The following conclusions can be drawn from these facts:

1) the Tigris at this latitude followed a course which more or less corresponded with its modern one (contra ADAMS 1965, Fig. 3, and *TAVO*, Map B II 12.1 [72]),

and

2) Puš should be located in the general region of the later Seleucia, where the Tigris and Purattum came very close together and probably even joined (on the question of such a junction, see below).

Moreover, if Puš, on the Zubi, and Dūr-Puš, on the Tigris, were identical or even in close proximity, then:

3) 'Zubi' was another name for 'Tigris.'

The identity of the two names tends to be confirmed by evidence showing that the town of Ḫibarītum was on the Zubi in the Ur III period [73] and on the Tigris in the Kassite era;[74] and it is virtually assured by lexical evidence from Erimḫuš and the Practical Vocabulary of Assur, which equate the sign ZUBI with both ÍD.ḪAL.ḪAL.LA and *Diglat*, two ancient designations of the Tigris.[75] Finally, if the Irnina joined the Zubi/Tigris above Puš, then:

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69 The confluence of the Irnina and Zubi is demonstrated by the Cadastre of Ur-Nammu (KRAUS 1955, 46-47 A ii 24-iv 26). For a schematic reconstruction based on the section mentioning these two watercourses, see STEINKELLER 1980, 33 (translation on p. 26, n. 15).

70 For the Ur III evidence, see STEINKELLER 1980, 27. For the association of Puš and Sippar in the Old Babylonian period, see, e.g., WALKER 1986, No. 3: 11-12.

71 FEIGIN 1979, No. 469: 4-5. The field was given to the *nadītum* Bēltāni during the reign of Samsuiluna. The tablet recording the gift (YBC 6816) was kindly collated by U. Kasten, who confirms that the sign in question is IDIGNA not ZUBI (contra GIBSON 1972, 13, n. 62, and STEINKELLER 1980, 27, who incorrectly cites *YOS* 12 468 rather than *YOS* 12 469). Kasten also noted that there is no break in the middle of line 4, as indicated in Feigin's copy.

72 This proposed course for the Tigris is difficult to explain from a topographical and geomorphological point of view.

73 KRAUS 1955, 46 ii 26, 47 iv 12-13.

74 LUTZ 1919, No. 15: 14-15; see also KRAUS 1955, 63.

75 [ZU]BI = ÍD.ḪAL.ḪAL.LA (CAVIGNEAUX *et al.* 1985, 90 r. iii 13'); ÍD.ZUBI = *di-[ig-lat]* (LANDSBERGER and GURNEY 1957-58, 333: 739 — *di-[ig-lat]* is restored after an unpublished copy by Geers of VAT 14253, see *CAD* Z, p. 13a s.v. *zā'ibu* lexical section). KRAUS (1955, 63) also equated the Zubi with the Tigris, as did HALLO (1964, 68), who saw the Zubi as a short canal between Sāmarrā and Baghdad (this

4) their junction must be sought north of Seleucia near the present confluence of the Diyala and Tigris (see Map 8), where there is physical evidence that the Euphrates and Tigris systems joined in the past.[76]

On this basis, therefore, we propose to identify the course of the Irnina with the line of fossil meanders which begins about 20 km northwest of Abū Ḥabbah and then crosses the plain between the Euphrates and Tigris in an easterly direction, passing by Abū Qubūr, and afterward turning slightly northeast and then east to the Tigris near the latter's junction with the Diyala (see Map 8).[77] Another plausible candidate is the line of meanders to the north which crosses the plain in a northeasterly, then southeasterly direction approximately midway between ʿAqar Qūf and Abū Ḥabbah, and then possibly joins the above-mentioned line some 10 km north-northeast of Tell ed-Dēr (via the course indicated by the dashed line). We would prefer to identify this latter line, however, with a later watercourse called the Patti-Enlil, which we will treat further on.

Not only is a roughly accurate localization of Puš essential to the proper placement of the Irnina, but so is an approximately correct localization of Namzium (Namsûm), Ḫirītum, and Ḫibarītum, inasmuch as the former two towns were situated on the bank of the Irnina and the latter was located on the bank of the Zubi above its confluence with the Irnina. The relevant evidence for the locations of these towns is presented in the following paragraphs, where it will be demonstrated, once more, that

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location, however, is much too far north). GIBSON (1972, 6) equated the Zubi with what he called the 'Jemdet Nasr branch' of the Euphrates (see also JACOBSEN 1960, 176), although he admitted that at some time "the Zubi seems to have been connected, or considered part of the Tigris system" (*ibid.*). See also *CAD* Z, p. 14a s.v. *zā'ibu* discussion section: "The logogram ZUBI seems to have referred originally to a specific arm of the Tigris in southern Babylonia." Even the logograms representing Zubi and Tigris are written similarly. They are either orthographic variants of the same sign or they go back to a common original (HALLO 1964, 68).

76 It must be stressed that a junction between the two systems south of the latitude of Sippar is precluded because of topographical constraints.

77 A ccording to FRANKENA 1966, No. 70 (see also HARRIS 1975, 114, and n. 164), the Irnina was either at least 51.8 km long (see e.g. WAETZOLD 1975, 278 s.v. Irnina) or at least 25.9 km long, depending on how one interprets the text in question (a letter from Abi-ešuḫ to various high officials in Sippar concerning the imminent arrival of a high flood). The document states simply that 120 UŠ and 24 UŠ of the banks of the Irnina were to be reinforced by the palace and the officials of Sippar respectively, the total distance mentioned being 144 (UŠ) x 720 (cubits per UŠ = 360 m) = 51,840 m = 51.8 km. This figure, which may be a measure of the distance along either one of its banks or both of them together, most probably refers to that portion of the Irnina that was located within the administrative realm of Sippar (which could have plausibly included the entire course of this channel). The important point here, however, is that no matter how this measure is interpreted, the information contained in this letter neither precludes locating the Irnina north of Sippar nor favors locating it to the south of this city.

Also, on the basis of several Mari letters which state that Namsûm and Puš were 'below' (*šaplānum*) Sippar, it has been assumed that the course of the Irnina (with which both were associated) had to be situated 'south' of this city (see e.g. BIROT 1993, 228, note a, 234, note f; LACAMBRE 1997, 439, n. 72). We disagree, but we will deal with this matter below in connection with our discussion of the evidence bearing on the town of Ḫirītum (see especially n. 104).

the course of the Irnina had to be situated north of Sippar. We will begin with the evidence for Namzium and Ḫibarītum and then turn our attention to Ḫirītum, the latter being particularly well documented since it was the site of a major confrontation between the Elamites and the allied forces of Babylon and Mari during the time of Hammurabi and Zimri-Līm.

In the Cadastre of Ur-Nammu, in the section delineating the boundaries of the district belonging to the moon-god Sîn, the town of Namzium is said to have been situated on the Irnina, a waterway which formed much of the district's southern frontier.[78] From the detailed description given in the text, it is clear that Namzium lay not far northwest of Puš. Therefore the Irnina also lay northwest of Puš (that is, northeast of Sippar [79]), because Puš, as we have just seen, was situated close to both the Purattum and the Zubi/Tigris, below the Irnina's junction with the latter. (For a reconstruction of the district of Sîn incorporating our proposal for the course of the Irnina and the approximate locations of the more prominent toponyms of the district, see Map 5.) A location north of Sippar for Namzium (and thus the Irnina) is confirmed by an Old Babylonian text from Ur, which contains an account of the money spent on a journey from Mankisum (on the Tigris some distance upstream from Baghdad) [80] to Namzium, Sippar, and finally Kish.[81] The order of the destinations shows that Namzium (and the Irnina) was located north of Sippar rather than on the branch of the river flowing past Kutha to the south. Otherwise the route would make little sense. (For the approximate location of Mankisum, which is also one of the stops in the Old Babylonian itineraries, treated below, see Maps 6 and 7.)

The Cadastre of Ur-Nammu places the town of Ḫibarītum along the bank of the Zubi, to the north of Puš and above the confluence of the Irnina with the Zubi (see

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78 KRAUS 1955, 46-47 A ii 24-iv 26.

79 Compare FRAYNE (1991, 388-389), who situated the district of Sîn — and with it the Irnina — north of Sippar, and KRAUS (1955, 63), who situated it north or east, or north and east, of this city. STEINKELLER's (1980) proposal to locate the district of Sîn southeast of Sippar hinges on JACOBSEN's (1960, 176, and n. 4) interesting but ultimately baseless suggestions for the courses of both the Irnina and the Zubi.

80 The location of Mankisum on the Tigris above the confluence of the Diyala is beyond dispute. The Mari letters show that it was a strategic ford on the road between Ešnunna and Rāpiqum (see, for example, JEAN 1950, No. 25 : 9 ; DOSSIN 1951, No. 59 : 7-14 ; DOSSIN 1952, No. 33 : 6-10 ; and BIROT 1993, No. 140 : 15-16). A location at the latitude of Ešnunna or even higher is very probable, since according to DOSSIN 1952, No. 33 : 6-10, the Ǧazīrah (*kaṣûm*) lay directly west of the ford at Mankisum (see Maps 6 and 7).

A possible candidate for Mankisum is ADAMS' (1972, 190 and map 1A) site 045 (Tell Kurr), which lies on the east bank of 'course B' (Mid-Holocene to approximately 13th century AD) of the ancient Tigris as reconstructed by WILKINSON (1990a, 126-127). Mankisum should then be located slightly above the northern limit of our Maps 6 and 7, about 4 km west of the present bed of the Tigris.

81 The text in question is *UET* 5 685, discussed by LEEMANS (1960, 170-171).

Map 5).[82] The Old Babylonian itineraries, in turn, place Ḫibarītum three stops beyond Sippar-ṣērim (Abū Ḥabbah) and three stops downstream from Mankisum (see Map 6).[83] This again situates the Irnina north of Sippar, not south of it, as the following analysis shows.

The itineraries in question trace the route followed by a military or trading expedition originating in Larsa and bound for Upper Syria, with the initial leg, from Larsa to Mankisum, almost certainly being undertaken by boat.[84] Our concern here is the latter half of this leg, from Sippar-ṣērim (Abū Ḥabbah) to Mankisum. Concerning this portion of the itinerary we are told that after the expedition arrived in Sippar-ṣērim from Babylon, it passed along the Purattum to Sippar-dūrim (Tell ed-Dēr). The locations of the two Sippars are well known. The next stop, Dūr-Apil-Sîn, a town which is attested in texts from Abū Ḥabbah and Tell ed-Dēr, was located on a navigable waterway [85] and its territory seems to have been adjacent to that of Kār-Šamaš,[86] a town known to have been situated on the Purattum.[87] A location between Tell ed-Dēr and the Tigris is probable.[88] From Dūr-Apil-Sîn the expedition traveled to Ḫibarītum, which, as we have seen, was situated on the Zubi in the Ur III period and on the Tigris in the Kassite era,[89] and which is undoubtedly to be sought in the region of modern Baghdad. After Ḫibarītum, the next stop mentioned is Kār-Kakkulātim, the quay area of the well-known town of Kakkulātum.[90] The latter was situated on the Tigris below Mankisum, since a letter from Mari reports that troops traveled from Ḫirītum (on the

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82 KRAUS 1955, 47 iv 1-19.

83 GOETZE 1953, 51 i 11-19; HALLO 1964, 63 obv. 5-9.

84 According to GOETZE 1953, 51 i 18-19 (copy p. 52), Mankisum was the point in the journey from Larsa "when ... the boats retu[rned]" (*i-nu-ma* ... GIŠ.MÁ.ḪI.A *i-tu-*⌈x⌉[(-x)]). Goetze transliterated the broken verb here as *i-li-[ka-nim]* (GOETZE 1953, 51 i 19). But despite his strenuous objections (GOETZE 1964, 115, n. 15) to Hallo's reading *i-tu-*⌈*ru-ú*⌉, itself a misrepresentation of Landsberger (*apud* LEEMANS 1960, 170), who had suggested instead the reading *i-tu-*[*ra* or *ra-nim*], Goetze's copy clearly shows a TU-sign and not the beginning of a LI (compare, e.g., the TU- and LI-signs in GOETZE 1953, 53 iii 14 and 54 iii 29).

85 The location of Dūr-Apil-Sîn on a watercourse is confirmed by DOSSIN 1933, No. 33, which concerns grain that is to be transported there from Sippar by boat. See also note 104 below.

86 This Kār-Šamaš should not be confused with the town of the same name on the Tigris (see below). For evidence that the territories of Dūr-Apil-Sîn and Kār-Šamaš were contiguous, see KLENGEL 1973, No. 17, which records the purchase of an undeveloped parcel of land witnessed by the elders of both towns (lines 19 and 23).

87 For evidence that Kār-Šamaš was located on the Purattum, see GOETZE 1948, 95 No. 23 : 5-6 and PINCHES 1964, 54 r. 15.

88 Note that in the first-millennium geographical list 83-3-23, 24 Dūr-Apil-Sîn follows Akšak/Opis and precedes KUR.TI, Sippar-^{d}Annunītum, Sippar-^{d}Šamaš, and Sippar-Amnānum (see REINER and CIVIL 1974, 63), which indicates a location between the longitudes of Opis and Sippar-Amnānum/Annunītum (rather than one to the NW of Sippar for example).

89 KRAUS 1955, 46 ii 26, 47 iv 12-13; LUTZ 1919, No. 15: 14-15.

90 GOETZE 1953, 56.

Irnina) to Kakkulātum, and then upstream to Mankisum (see Map 7).[91] Kakkulātum was undoubtedly also located in the region of modern Baghdad, since it is listed in association with towns of the lower Diyala region in a record of tax payments made to Ibbi-Sîn.[92] Kār-Šamaš and Mankisum, the next stops, were also on the Tigris.[93] The former was situated north of Baghdad, along a stretch of the Tigris channel that was prone to shifting,[94] and the latter, as we have seen, was located upstream from Kār-Šamaš, at the latitude of Ešnunna or slightly higher.

Therefore, if Ḫibarītum was located along the Tigris in the region of Baghdad (see Map 6), then Ḫirītum, another town on the Irnina,[95] was located to the southwest of Ḫibarītum, in the general region of Abū Qubūr (see Map 7).[96] As mentioned above, Ḫirītum was the site of a confrontation between the Elamites and the allied forces of Babylon and Mari during the Old Babylonian period. This Ḫirītum is almost certainly to be identified with the Ḫirīt(um) mentioned in later sources as the site of a battle in the province of Sippar early in 652 BC between Assurbanipal, king of Assyria, and Šamaš-šumu-ukīn, king of Babylon, his rebellious brother.[97]

The fact that two important battles in Mesopotamian history were fought at Ḫirīt(um) — both against enemies attempting to advance on Babylon from the north — indicates that the forward defense line of the capital ran through or very near this town. This was the narrow waist of Babylonia, where the Twin Rivers came closest together.[98] This was where Nebuchadnezzar II later built his cross-country defense known as the 'Wall of Media' (Map 9) and where he could easily flood the low-lying terrain to the north.[99] And finally this was also near where, some two centuries later, the forces of

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91 BIROT 1993, No. 145 : 9-23. The letter reports that the *sukkal* of Elam took 30,000 troops upstream (30 *li-mi ṣa-ba-am ... ú-ša-aq-qa*) from Kakkulātum to Mankisum.

92 KING 1912, Pl. 19ff. i 6, iv 14 ; see HARRIS 1955, 45, and n. 3, and 46.

93 The name of Hammurabi's 42nd year commemorates the construction of a wall along the bank of the Tigris at Kār-Šamaš (UNGNAD 1938, 181-182 ; HORSNELL 1974, 268-276). Apil-Sîn also connects Kār-Šamaš with the Tigris in one of his year formulae (e.g., PINCHES 1964, No. 11 : *Ka-ar-*^{d}UTU *ša a-aḫ I-di-ig-la-at*). For Mankisum, see n. 80 above.

94 A date formula of Apil-Sîn states that the king returned the bed of the Tigris to its former location (AL-RAWI 1993, 24: 16' : mu gú íd.idigna ki-bi-šè bí-in-gi$_4$-a) ; the formula is a variant of the one mentioning Kār-Šamaš (*ibid.*, 28).

95 According to the Cadastre of Ur-Nammu, Ḫirītum was west (or northwest) of Namzium (see KRAUS 1955, 47 A iii 12-21

96 HARRIS (1975, 88), citing the unpublished text BM 80327, also situated Ḫirītum north of Sippar. In her opinion it lay "close to Kar-Šamaš and on the water route between Sippar and Mankisum." We believe, however, that Abū Qubūr is the most plausible candidate for Ḫirītum (note the occupational history of this site presented in the tables opposite Maps 8 and 9).

97 GRAYSON 1975, 132, No. 16 (Akītu Chronicle) :13-15 ; SACHS and HUNGER 1988, No. -651 (BM 32312) iv 18'-19'. On this battle, see FRAME 1992, 145, 289-292 ; also LACAMBRE 1997, 439-440.

98 Compare Strabo, *Geography*, 2.i.26.

99 GASCHE 1989a, 31. If Nebuchadnezzar II had wanted to take advantage of the existing topography, he

Cyrus the Younger clashed with those of his brother Artaxerxes II, king of Persia, at the Battle of Cunaxa.[100] The following few paragraphs highlight the most important evidence from Mari letters bearing on the first battle of Ḫirītum,[101] concentrating on those containing information relevant to this town's — and the Irnina's — location north of Sippar.

After his overthrow of the kingdom of Ešnunna, the *sukkal* of Elam announced his intention to besiege Babylon itself.[102] He led his army from Mankisum, on the Tigris, downstream to Kakkulātum, and from there advanced to Ḫirītum and put it under siege (see Map 7).[103] Therefore Ḫirītum lay in relatively close proximity to Kakkulātum, which in turn was situated in the area of modern Baghdad, as we have demonstrated.

In response to the Elamite threat, contingents of the armies of Hammurabi and Zimri-Līm left Babylon and installed themselves in Namsûm (Namzium), which, as we have seen, was located on the Irnina downstream from Ḫirītum.[104] While the siege of

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could have reused the old channel of the Irnina to flood the depression to the north of his wall. He could have also directed the water of the Patti-Enlil into this depression. It is interesting to note that a wall may have been constructed alongside the Patti-Enlil a century or so earlier, but the letter which may allude to it requires collation (HARPER 1892-1914, No. 883 r. 3-6). The upper course of the Patti-Enlil, as we will see, ran very close to the former bed of the Irnina, and its lower course was almost identical with the latter's (see below *sub* 'Patti-Enlil').

100 Xenophon, *Anabasis*, I.vii.14-viii 29. On BEWSHER's (1867, 166) proposal to identify 'Tell Kuneise' (40 km NW of Sippar) with Cunaxa, see GASCHE 1995, 201, n. 1, and our Map 3.

101 For a recent analysis of the battle, including preliminaries and aftermath, see LACAMBRE 1997.

102 CHARPIN *et al.* 1988, No. 303 : 49'.

103 BIROT 1993, No. 140 : 15-18 ; CHARPIN and DURAND 1991, 63, n. 24, A.3618 : 21'-26' ; and LACAMBRE 1997, 448, A.3669 + M.5368 + M.8691 r. 35'-36'.

104 BIROT 1993, No. 140 : 6-7.

Namsûm is also described in this and another letter as being 'below' (*šaplānum*) Sippar (*ibid.*, lines 7-8 ; CHARPIN 1988, 17-18, n. 22, A.1873 : 4'). This has been understood by both BIROT (1993, 228, note a) and LACAMBRE (1997, 439, n. 72) to mean that the Irnina, on which Namsûm was located, was 'south' of Sippar, therefore following STEINKELLER's (1980) proposal to place this channel in the region between Sippar and Kutha. But the Akkadian term used — *šaplānum* — also means 'downstream,' and we have just seen that it was possible to travel by boat from Sippar-dūrim (Tell ed-Dēr) east to the Tigris via Dūr-Apil-Sîn. Note the three large secondary levees on the Maps [especially 2 and 6] which depart from the left bank of the Main Branch of the Euphrates east of Tell ed-Dēr and join the line of fossil meanders we have identified as the Irnina. These levees, as they appear now, are certainly not Old Babylonian in date, but the distribution pattern of the irrigation system was undoubtedly very much the same in the period with which we are concerned. Also, given the fact that they are important in size, and given the perenniality of the system, they could well conceal remains of earlier irrigation canals. We have arbitrarily located Dūr-Apil-Sîn along the central one of the three. It should be noted as well that our proposed location of the Irnina lies nowadays some 2-3 m lower than the top of the levee running from Abū Ḥabbah to Tell ed-Dēr. According to geomorphological evidence, the topographical situation was very similar during the second and first millennia BC. This is an appreciable difference in elevation over such a short distance. Therefore, *šaplānum* ('below') in the context could also mean that Namsûm was topographically lower than Sippar.

Ḫirītum was underway, Babylonian troops outflanked the Elamites and raided Ešnunna, setting fire to the grain crop and plundering livestock.[105] Hammurabi went to meet the returning men in Puš,[106] where he received their booty and gave them orders to turn around and renew their attack (see Map 7).[107] His movements and those of his troops would make little sense if we located Puš southeast of Kutha, as is now commonly done.[108]

Finally, after the *sukkal* of Elam was defeated at Ḫirītum, he retreated with his army directly across the Tigris to Kakkulātum, which he destroyed before proceeding upriver to Mankisum.[109] The Elamite itinerary again shows that Ḫirītum and Kakkulātum lay in relatively close proximity.

In sum, there can be little doubt that the course of the Irnina lay north of Sippar and not south of it. The evidence allows no other conclusion. Our task now is to identify the channel which passed through Sippar itself.

Purattum (Map 8)

During the first half of the second millennium, the upper course of the Euphrates through Syria continuing downstream to Sippar was called the Purattum. In the Mari texts the name of the river was spelled syllabically as *Pu-ra(-at)-tum* or *Pu-ra-an-tum* and logographically as ÍD.UD.KIB.NUN.KI (with the variant spellings ÍD.UD.KIB.NUN, ÍD.UD.KIB.NUN.NA, ÍD.UD.KIB.NUN.NA.KI, and ÍD.KIB.NUN.NA).[110] In administrative documents from Babylonia proper, the vast majority of attestations of ÍD.UD.KIB.NUN.KI and its variants[111] stem from the Sippar region, although the name is also attested in administrative texts from and concerning Uruk, Larsa, and Ur.[112]

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105 BIROT 1993, No. 141 : 17-19.

106 Also said to be 'below' or 'downstream from' Sippar (*ibid.*, lines 19-20). The comments made above in n. 104 about Namsûm apply to Puš as well; compare BIROT 1993, 234, note f; LACAMBRE 1997, 439, n. 72.

107 BIROT 1993, No. 141 : 19-22.

108 See, for example, LACAMBRE 1997, 433.

109 BIROT 1993, No. 145; also *ibid.*, Nos. 144 and 146; LACAMBRE 1997, 446, A.3669 + M.5368 + M.8691 : 9'-16'.

110 The Mari letters exhibit mostly syllabic spellings, but logographic writings are also common (see, for example, DOSSIN 1950, No. 62 : 17; JEAN 1950, No. 131 : 11, 37; CHARPIN *et al.* 1988, No. 31 : 37; No. 220 : 8; BIROT 1993, 27 No. 107 r. 3', 14'; No. 118 : 9; and No. 151 : 48, 53). Sargonic inscriptions refer to the Euphrates in Syria as UD.KIB.NUN.ÍD (and variants). For a recent analysis of the third millennium evidence bearing on the Euphrates, see CARROUÉ 1991.

111 Syllabic spellings are rarely, if ever, attested in documents from the south.

112 KLENGEL 1973, No. 100: 13 (Uruk [ÍD.UD.KIB.NUN.KI *ša* UNUG.KI]); FRANKENA 1966, No. 4 r. 8'-9' (between Larsa and Ur), and FIGULLA and MARTIN 1953, No. 181 : 5 and Nos. 855-856 (at Ur); see also LEEMANS 1976, 216.

According to the physical traces of the levees themselves, the Euphrates bifurcated some 20 km downstream from the Fallūğah Terrace, not far from the point where the Irnina departed from the left bank of the river toward the Zubi/Tigris. Below the bifurcation one channel flowed in a southeasterly direction toward Abū Ḥabbah (Sippar) before turning to the northeast in the direction of Tell ed-Dēr (Sippar-Amnānum), while the other flowed in a more southerly direction toward the Iskandarīyah Terrace which it roughly paralleled before turning directly south.[113]

The Main Branch of the Purattum (Map 8)

It is certain that the first of the two channels mentioned in the preceding paragraph — that upon which both Abū Ḥabbah and Tell ed-Dēr are situated — was the Purattum, since the logographic writing of this name, ÍD.UD.KIB.NUN.KI, means 'River of Sippar,' and an ancient map of the region, BM 50644, labels this branch as such.[114] Therefore we will call this channel the Main Branch of the Purattum (see Map 8).[115] It is also certain that east of Tell ed-Dēr this same channel approached the Tigris in the region where Seleucia would later be built, because a field belonging to a *nadītum* is described as bordering on both the Purattum and the Tigris.[116] There is therefore a strong possibility that the two rivers joined here, but firm evidence will be lacking until further investigation is carried out in the region east and south of the present project area. At the moment we favour the following hypothesis (see Map 8) : [117]

> If we posit that the Main Branch of the Purattum and the Tigris/Zubi joined south of where Seleucia would later be founded, then the common course of two rivers most probably followed the large levee that departs at this point in a southeasterly direction from the modern bed of the Tigris.
>
> Some 25 km downstream, near site A166, this common course bifurcated. One fork of the river flowed almost directly southward to a point just east of Jemdet

[113] For the locations of levees with fossil meanders on their summits, see Map 1. For the proposed courses of the two channels in the area of Sippar, see Map 8.

[114] THOMPSON 1966, Pl. 49, and republished by L. De Meyer in GASCHE and DE MEYER 1980, 6. The map is perhaps a late copy, but the original from which it was reproduced goes back to the Old Babylonian period. This is demonstrated by the notation UD.KIB.NUN.KI-*i*[*a*-...], which is obviously to be restored as UD.KIB.NUN.KI-*i*[*a-aḫ-ru-rum*] = Sippar-Jaḫrurum, a designation of Sippar that is not attested after the end of the Old Babylonian period.

[115] Before the existence of this channel was established (GASCHE and DE MEYER 1980), a putative channel from (Abū Qubūr to) Sippar to Kish, Nippur, and districts south of Nippur was similarly labeled. It was called the "main course of the Euphrates" (JACOBSEN 1960, 175-176) and "main bed of the river" (GIBSON 1972, 5) in the older literature, and has even been considered the "most important early bed" (ADAMS 1981, 159) and "main channel of the Euphrates" (BRINKMAN 1984, 175) in the later literature.

[116] FEIGIN 1979, No. 469 : 4-5 (collation by U. Kasten shows IDIGNA not ZUBI).

[117] It should be noted that this hypothesis differs slightly from that which we have proposed in the proceedings of the Berlin colloquium.

Nasr. A reexamination of the topography of the area in question suggests that this fork did not continue southward after reaching the latitude of Jemdet Nasr, as hypothesized in our Berlin paper, but rather that it turned to the southeast (see Map 8). This is because the terrain in this region slopes from the 'Kutha levee' in the direction of Jemdet Nasr rather than the other way round. However, the present state of our archaeological and textual documentation precludes us from identifying with certainty both the name of this branch and the names of the two others east of site A166. (We believe, though, that the more northerly of the latter two was in all likelihood a stretch of the ancient Tigris.)

The Kish Branch[118] *of the Purattum (see also below, sub Araḫtum) (Map 8)*

We know that the Purattum flowed past Kish from at least the middle of the Akkadian period until late in the reign of Samsuiluna, because an inscription from the reign of Narām-Sîn and the date formula for Samsuiluna year 24 both place Kish on the bank of this river.[119] However, from a topographical point of view, it is impossible to connect the common course of the Main Branch of the Purattum and the Tigris/Zubi with the river network centered on Kish/Kutha, because the water would have had to flow uphill from the latter to the former beginning near Jemdet Nasr.[120] Therefore, the Purattum through Kish has to be identified with a channel that followed the levee to the south of Sippar. This is a channel that flowed roughly parallel to the Iskandarīyah Terrace, then turned south in the direction of Babylon until reaching a point about 32 km north of the capital, where it followed the levee upon which Kutha (Tell Ibrahim) is located for some 15 km[121] before again turning south toward Kish (see Map 8). In our reconstruction we will call this channel the Kish Branch of the Purattum.

Beyond Kish, the watercourse in question flowed in an easterly direction and then turned southeast. If further investigation eventually demonstrates that this channel continued on to Nippur, then it can also be identified as the Purattum, because Samsuiluna claims to have built a wall along the ÍD.UD.KIB.NUN.KI here.[122] It would also

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118 GIBSON (1970, esp. p. 114) used the same name, but the course he reconstructed (*ibid.*, Fig. 69) differs from the one reconstructed in the present study.

119 FRAYNE 1993, 106-107 iii 13'-iv 35' ; UNGNAD 1938, 184 (see HORSNELL 1974, 389-395).

120 See the drainage pattern of this area as illustrated on Map 2.

121 It is interesting to note that many of the sites located on the 'Kutha levee' (except Kutha itself) are concentrated along this 15 km stretch (see Map 3). Despite the fact that this levee remains high and wide downstream of the stretch in question, we could not find a name for the ancient waterway which amassed it, although traces of meandering watercourses both on top of and on the southern slope of the levee southeast of Kutha are shown by DOUGRAMEJI and CLOR (1980, Fig. 5, the units labeled OR = Old River Bed Soils [we owe this information to K. Verhoeven]).

122 FRAYNE 1990, 374 : 34-37.

then be identifiable with an older watercourse named the 'River of Kish' (ᵈÍD.KIŠ.KI), which is attested in an early Sargonic text from Nippur.[123]

Araḫtum (Map 8)

The Araḫtum is attested with certainty beginning only in the reign of Sumulael.[124] Babylon's location on the Araḫtum is shown by a contract from the capital recording the rental of boats for a journey to the mouth of this channel ;[125] Dilbat's location on it is well known.[126] We propose, therefore, that at least during the early part of the second millennium this channel departed from the right bank of the Purattum (Kish Branch) some 32 km north of Babylon, at the point where the latter waterway turned toward Kish.

The situation is complicated, however, by evidence that the Araḫtum also flowed in the proximity of Sippar. According to a real estate document from this city dating roughly to the time of Abi-ešuḫ, a dike of the Araḫtum formed one of the boundaries of a field belonging to the *ugārum* of Ṭābum,[127] an irrigation district which is attested in some 40 Old Babylonian texts from Sippar.[128] Evidence for the Araḫtum's proximity to the Purattum is found in another real estate text from this city, wherein the latter is named as the border of another field in Ṭābum.[129] In this district, therefore, the Araḫtum flowed fairly close to the Main Branch of the Purattum (the river through Sippar and Sippar-Amnānum). Ṭābum, then, must have been located west or northwest of Sippar. It is interesting to note that the Araḫtum near Sippar was apparently even called 'Upper Araḫtum' (ÍD.*A-ra-aḫ-tum* AN.TA) in certain texts of the period.[130] This

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123 WESTENHOLZ 1975, No. 24 ii 7.

124 GAUTIER 1908, No. 3. The attestation *mu-kin*-íd.KA-*a-ra-aḫ-tum*-ma-ka-šè in the Ur III text *BE* 3 84 r. iii 50 may refer to the Araḫtum, but the interpretation of the passage is problematic, see CARROUÉ 1991, 126-128. For an Early Dynastic reference to a possible Sumerian equivalent, see BRINKMAN 1995, 22-23, n. 35.

125 VAN DIJK 1968, No. 59.

126 See, e.g., GAUTIER 1908, No. 3 ; KLENGEL 1973, Nos. 19 and 23 ; etc. The latter two include a tablet which records the exchange of a field bordering on the Araḫtum, with the elders of Dilbat confirming the transaction, and another which records the purchase of a field, also on the Araḫtum, with the *šatammu* of Dilbat acting as one of the witnesses.

127 VAN LERBERGHE 1986, No. 37 : 31' (we thank M. Tanret for having brought this document to our attention). It can be roughly dated because of prosopographical connections to *ibid.*, No. 36, which bears the date formula of Abi-ešuḫ year "aa."

128 See, e.g., HARRIS 1975, 379 ; DEKIERE 1994, 271-272 ; *idem* 1994a, 308 ; *idem* 1995, 140 ; *idem* 1996, 318-319 ; and *idem* 1997, 171.

129 DEKIERE 1996, No. 675 : 5-6, 31-32.

130 See, e.g., SZLECHTER 1963, 83 (Umm G 18) : 1 and YBC 11041 : 2 (unpublished).

This stretch of the river was still known as the Araḫtu(m) in the early seventh century BC. In 694, Sennacherib led a flotilla down the Tigris to Opis, where his inscription states that the boats of his

raises the possibility that there were two different names for a single stretch of the same river beginning late in the reign of Samsuiluna or during the reign of Abi-ešuḫ.

The evidence summarized above can be harmonized only if we assume a westward shift of the Euphrates system toward the Araḫtum line through Babylon, the capital. As we have already documented, this was a period marked by both sluggish flow and periodic catastrophic flooding in the Euphrates system. Under such conditions lateral cutting, course substitution, and avulsion could occur, the latter being a phenomenon in which old sediment-choked channels flood, break their banks, and initiate new channels which eventually conduct the entire flow. Something like this probably began to happen already at the end of the reign of Hammurabi, when this king claims to have "dug the Purattum to Sippar." [131] Then by late in the reign of Samsuiluna or shortly thereafter, water volume in the Kish Branch may have dropped to a level sufficiently low to create conditions conducive to a shift of flow to the west, along the Sippar-Babylon line, which then became known as the Araḫtum not only at Dilbat and Babylon but also upstream all the way to its point of divergence from the Purattum some 20 km northwest of Sippar.[132] This shift would have had a deleterious effect on the water supply of all settlements previously connected with the lower course of the Kish Branch of the Purattum (including Kish itself).

Abgal and Me-enlilla (Map 8)

The Euphrates channel known as the Abgal,[133] which is first attested in the Akkadian period, was clearly situated east of the Araḫtum,[134] not west of it.[135] The oft-repeated notion that the Abgal should be identified with the Pallakottas channel mentioned by Arrian and Appian [136] and with the Pallukkatu channel attested from the mid-sixth century on [137] should be discarded. Jacobsen, among others, assumed a phonetic development Abgal > Apkallatu [138] > Pallukkatu > Pallakottas, and suggested

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expeditionary force were hauled overland to the Araḫtu (LUCKENBILL 1924, 73 : 57-64). This was an ideal place for portage, because it was here that the Twin Rivers came closest together (compare Strabo, *Geography*, 2.i.26).

[131] FRAYNE 1990, 348 : 16-18 (Sumerian), 20-22 (Akkadian).

[132] We saw above that this upper stretch was even called the 'Upper Araḫtum' in contemporary documents.

[133] The name is almost always written ÍD.ÁB.GAL or ÍD.ABGAL (NUN.ME) ; however, in a lexical list from Emar it is written *Ap-kal-li-tu*₄ (ARNAUD 1987, 148 : 40').

[134] As correctly observed by FRAYNE (1992, 49), although he elsewhere incorrectly situates Kazallu, Kiritab, and Api'ak — territories through which the Abgal coursed — north and south of Borsippa (*ibid.*, Map 2 on p. 8).

[135] Contra, *inter alia*, BARNETT 1963, 11 ; GIBSON 1972, 24; EDZARD and FARBER 1974, 252-253 ; GRONEBERG 1980, 272 ; and COLE 1994, 86-87.

[136] See, for example, Arrian, *Anabasis Alexandri*, VII 21.1-4 (= BRUNT 1983, 277-279).

[137] For a portion of the documentation, see JURSA 1995, 201-203.

[138] This spelling does not actually exist, but compare *Ap-kal-li-tu*₄ (ARNAUD 1987, 148 : 40').

that this channel stemmed from the Araḫtum and lay south of Babylon.[139] Gibson and Adams later identified the Abgal with an even more westerly branch of the Euphrates.[140] However, documentary evidence from the period in question speaks directly against locating the Abgal along the western margins of the alluvial plain.

The Abgal in fact branched from the right bank of the Kish Branch of the Purattum near Kish itself and then flowed on toward Marad. From a point about one-third of the way from Kish to Marad, the Abgal probably followed the approximate line of the modern Hillah branch of the Euphrates, which here flows almost directly north-south. Evidence for the Abgal's association with Kish is found in a document from this city which records the purchase of a field bordering on the Abgal.[141] The transaction is sworn by Zababa, and several of the witnesses also bear names with Zababa as their theophoric element.[142] Evidence that the Abgal continued on from Kish to Kiritab, Api'ak, and finally Marad comes from a variety of texts.[143] The Maništušu Obelisk records the sale of a field bordering on the Abgal within the territory of Kiritab (Girtab),[144] which the Cadastre of Ur-Nammu shows was situated north of Api'ak [145] (a district traversed by the Abgal from north to south),[146] which in turn was located just north of the territory of Marad.[147] In the Isin-Larsa period, the region from Kish to Marad was dominated by the kings of the Mananâ Dynasty.[148] One of these kings, Sumuditāna, who ruled both Kish and Marad, states in a year formula that he

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139 JACOBSEN 1960, 177, and n. 6.

140 GIBSON 1972, 5 ; ADAMS 1981, 159. Gibson, following the conclusions of MEISSNER (1896), suggested that the channel ran in much the same bed as the present-day Hindīyah (see also CARROUÉ 1991, 123), while Adams suggested only a westerly course.

141 FIGULLA 1914, No. 3 and No. 3a (envelope).

142 FIGULLA 1914, No. 3 : 17 and r. 5-7 respectively. The correct provenience of the tablet was established by KRAUS (1955, 56, n. 1).

143 Based on his thorough examination of the sources for the Mananâ Dynasty, CHARPIN (1978, 37-38, n. 77) seems to have been the first to observe that the Abgal flowed from Kish to Marad. The unwarranted identification of the Abgal with a much later channel west of Babylon has often led to the incorrect localization of Kiritab and Api'ak, which were clearly located between Kish and Marad rather than further west, below (or even above) Borsippa (see, for example, KRAUS 1955, 60 ; CARROUÉ 1991, 127, Fig. 1 ; FRAYNE 1992, 8, Map 2 ; and *TAVO*, Map B II 9.2).

144 GELB, STEINKELLER, and WHITING 1991, 127-129 B viii-xxii 17 (Abgal occurs in col. ix 6).

145 In fact their territories were contiguous, sharing a common border at An-za-gàr-ᵈNu-muš-da (KRAUS 1955, 46 A i 11 [Kiritab], 46 ii 19 [Api'ak]).

146 KRAUS 1955, Pl. V after p. 74.

147 Api'ak and Marad shared a common border at Me-en-*ì-lí* (KRAUS 1955, 46 ii 2, 4 [Api'ak], 48 iv 1-2 [Marad]). Further confirmation of Api'ak's location between Kish and Marad (and not further west) is found in the NB temple list BM 55476 (82-7-4,49), which groups the temples of Apâk with those of Kish, Hursagkalama, and Kutha (for edition and discussion, see GEORGE 1993, 49-56).

148 CHARPIN 1978.

(re-)excavated the bed of the Abgal,[149] while Ḫaliyum, an earlier king, named one of his years for his damming of the Abgal and the Me-enlilla.[150]

The Me-enlilla is first attested in the Ur III period. Although this channel falls outside the parameters of the present study, its close association with the Abgal calls for several comments here. It probably branched from the left bank of the Abgal (closer to Marad than to Kish) and then, according to the Ur III cadastre, flowed east-southeast along the northern border of the territory of Marad.[151] Other evidence associating the Me-enlilla with the Marad region is found in two texts recording purchases of orchards on the bank of the Me-enlilla which are sworn by Lugal-marada, city-god of Marad, and kings of the Mananâ Dynasty.[152] The Me-enlilla is also mentioned in a letter from Larsa,[153] perhaps indicating that this channel continued on to Larsa via the Nippur region. This watercourse is often linked with the Abgal in the textual record. As already noted, the Abgal and Me-enlilla are mentioned together in one of the year names of Ḫaliyum.[154] In addition, an Old Babylonian forerunner of HAR-ra = *ḫubullu* XXII lists them together;[155] an Ur III letter found at Kish[156] mentions a 'dike manager

[149] RUTTEN 1958, 219 No. 4 : 21-23 ; but for correct reading, see CHARPIN 1978, 37-38, n. 77.

[150] CHARPIN 1978, 25.

Our localization of the Abgal between Kish and Marad implies that the western end of the so-called 'Amorite Wall' (Murīq-Tidnim) of Šū-Sîn must have been located considerably further south than where it was placed by BARNETT (1963, 20-26) and WILCKE (1969-70, 9-10), who wanted to locate it near Fallūğah. A letter from Šarrum-bāni to Šū-Sîn reports that the sender had supervised the construction of a wall from the bank of the Abgal to the territory of Simudar (thought to have been in the Diyala region) and that thanks to his exertions there now existed a fortification 26 danna in length (= *c.* 260 km ; see WILCKE 1969-70, 8 : 3-12 ; also MICHALOWSKI 1976, 229 : 3-12). The cited length of the wall, if accepted at face value, most probably included the length of the earlier wall built by Šulgi, which stretched some 60 km from Bàd-igi-ḫur-sag-ga ('Wall-Facing-the-Mountain') through Gír-lum-tur-ra to the Abgal (WILCKE 1969-70, 15 : 14-24). We posit, therefore, that this latter wall began southwest of Dilbat at the edge of the Western Plateau (= ḫur-sag-ga — see EDZARD 1957, 47, n. 207) and ran northeast through Gír-lum-tur-ra (associated with Kazallu and Marad — see VAN DER MEER 1938, Pl. 52 ii 37-40]) to the Abgal some 20-30 km south of Kish. Šū-Sîn's wall then extended Šulgi's fortification another 200 km to the northeast, to the outlying hills of the Zagros, at a point almost equidistant between Dēr and the Diyala (see *TAVO*, Map B II 12.1). It must be stressed again that the Abgal was not associated with the later Pallukkatu, which in turn could not possibly have departed from the river as far north as Fallūğah (see below, *sub* 'Pallukkatu').

[151] KRAUS 1955, 47 B i 4, 9-10 (text very broken). According to JACOBSEN (1960, 177) and GIBSON (1972, 5), the Me-enlilla originated from the Euphrates at Kish and connected the city with Marad. In fact it was the Abgal which connected the two cities. FRAYNE (1992, 49) suggests that the Abgal branched from the Me-enlilla, with the former going to Nippur and the latter to Marad, which seems to be the reverse of the actual situation.

[152] The kings in question are Sumu-ditāna and Sumu-numḫim, see SIMMONS 1961, 55 Nos. 127-128.

[153] LUTZ 1917, No. 83 : 13.

[154] CHARPIN 1978, 25.

[155] REINER and CIVIL 1974, 144 i 8-9.

[156] GENOUILLAC 1925, D 60.

of the Abgal and Me-enlilla';[157] and another Ur III letter from the reign of Ibbi-Sîn refers to a promise by Enlil (and its subsequent fulfillment) that Išbi-Erra would win control over the banks of the Tigris, the Purattum, and the Abgal and Me-enlilla.[158]

5. THE KASSITE AND POST-KASSITE PERIODS

The identification of the major watercourses of the Kassite period, particularly in the region north of Babylon, is almost impossible at the present time, inasmuch as the overwhelming majority of texts dating to this era stem from Nippur, of which only a small percentage has been published.[159] Moreover, the texts from ʿAqar Qūf (Dūr-Kurigalzu) and Babylon — while originating from the region that is the focus of this investigation — provide little information on local topography.[160] In other words, the evidence for the region north of Babylon is meager, and the evidence from the region south of Babylon is largely unexploitable and irrelevant to the present investigation.

Despite BRINKMAN's (1968) exhaustive study of the post-Kassite period, the paucity of textual material makes it almost impossible to reconstruct the river network of Babylonia between *c.* 1150 and 750 BC. The archaeological evidence from this period is also meager (very little was known, for example, of the post-Kassite pottery assemblages at the time the large surveys were conducted on the floodplain). Although ARMSTRONG's (1989) study has begun to fill in the picture of this nascent corpus — at least for Nippur — it cannot be used for a spatiotemporal redistribution of sites previously dated by means of uncertain pottery indicators. A similar situation obtains for the late second-millennium material recently excavated at Isin and sometimes erroneously attributed to a later period (cf., for example, ARMSTRONG 1989, 89).

6. MAJOR WATERCOURSES IN THE FIRST HALF OF THE FIRST MILLENNIUM (esp. 750-500)

Patti-Enlil (Maps 5 to 7, 9)

Evidence from several sources shows that a watercourse departed from the left bank of the Purattu and then flowed south of ʿAqar Qūf (Dūr-Kurigalzu) into the

157 WILCKE 1969-70, 4 : 21 (= MICHALOWSKI 1976, 201 : 21).

158 ALI 1964, 42 : 8 and 44 : 44 (= ALI 1970, 160 : 8 and 162 : 44 = MICHALOWSKI 1976, 254 : 8 and 255 : 44). This enumeration of watercourses in Babylonia at the end of the Ur III period parallels one found in the legend of the insurrection against Narām-Sîn, wherein it is said that the Akkadian king was the guardian of the sources of the Irnina, Tigris, and Purattum (GRAYSON and SOLLBERGER 1976, 111 G : 7).

159 BRINKMAN 1976, 41-42. The 80 or so inscribed objects from Ur contain little topographical information.

160 BRINKMAN 1976, 43-44. Also, in the case of the more than 200 texts excavated at ʿAqar Qūf between 1942 and 1945 far fewer than half have been published.

Tigris.[161] It is called the Patti-Enlil in texts from Babylonia during the Kassite and Neo-Babylonian periods,[162] and perhaps the Patti-Bēl in Neo-Assyrian sources.[163] Evidence for its location is found in an early ninth-century inscription of Tukulti-Ninurta II, who, after reaching Dūr-Kurigalzu from the Tigris,[164] claims to have crossed this watercourse on his way to Sippar-of-Šamaš (Abū Ḥabbah).[165] Over a century later, Tiglath-pileser III claimed that he re-excavated its bed after a long period of abandonment;[166] and afterward, during the reign of Sargon II, two associates of Nabû-bēl-šumāte, the legate of Birat, supervised a survey of this watercourse (and possibly another called the Nār-Ḫirīte [167]) to determine its navigability.[168] As it turns out, the waterway was both navigable and connected with the Tigris, since Ṭāb-šar-Aššur, the royal treasurer, wrote to Sargon about an impending shipment of timber by river from the province of Guzāna to Nineveh that would have had to pass down the Ḫabūr to the Euphrates, across the Patti-Enlil, and up the Tigris.[169] Ṭāb-šar-Aššur reported that a similar shipment had reached Nineveh the previous year from Sapirrutu on the middle

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161 For a proposal to identify the Patti-Enlil with the Nahr ʿĪsā of Abū-el-Fedā and the modern Saklawīyah, see TAHA BAQIR 1944, 5. In our opinion, one of the ancient channels evident in the area south of ʿAqar Qūf but north of Abū Ḥabbah would be a better candidate for the Patti-Enlil (see above *sub* 'Irnina and Zubi').

162 The name is written ÍD.*Pa-at-ti*-^{d}EN.LÍL in a Kassite letter from Nippur (RADAU 1908, No. 28: 11) and ÍD.*Pat-ti*-^{d}EN.LÍL in a Neo-Babylonian sale document from Kish (WATELIN and LANGDON 1930, Pl. 16 W 1929, 142: 5).

163 In Neo-Assyrian sources the name is written ÍD.*Pa-at-ti*-^{d}BE, ÍD.*Pat-ti*-^{d}BE, ÍD.*Pat-ti*-^{d}BI, and ÍD.*Pat-ti*-^{d}EN and is sometimes therefore referred to as the Patti-Bēl (see, for example, PARPOLA 1970, 275; *idem* 1972, 25).

164 After a three-day march through a thicket (GRAYSON 1991, 173: 51 [for GIR.TIR read GIŠ.TIR, see SCHRAMM 1970, Pl. II after p. 158]). This is an obvious reference to the perennial jungle of reeds in the large depression north of ʿAqar Qūf (on which see, e.g., TAHA BAQIR 1944, 5).

165 GRAYSON 1991, 174: 52-53.

166 TADMOR 1994, 42 (Ann. 9): 4-5.

167 Spelled ÍD.*ḫi-ri-te* in a Neo-Assyrian letter to Sargon II (see PARPOLA 1987, No. 210: 8-16). If this grapheme was intended to represent the proper name Nār-Ḫirīte, then it is undoubtedly connected with the toponym Ḫirīt(um), which was situated on the former course of the Irnina and was also the site of two important battles in Mesopotamian history (on which see under 'Irnina and Zubi' above). It should be noted, however, that two contemporary Neo-Assyrian inscriptions (LUCKENBILL 1924, 79: 11; SCHROEDER 1922, No. 141: 221) employ the grapheme ÍD.*ḫi-ri-tu* (with determinative) to represent a generic Akkadian word for 'canal' (i.e., *ḫirītu*).

168 PARPOLA 1987, No. 210. Nabû-bēl-šumāte is called 'Nabû-bēl-šumāte of Birat' in this text and 'Nabû-bēl-šumāte, legate of Birat,' in PARPOLA 1987, no 84 (where it is also indicated that his jurisdiction extended to Sippar). Birat was situated on the Euphrates between Borsippa and Ḫindānu (*ibid.*, No. 87), probably in the region where the Patti-Enlil branched from the river, since it is mentioned in connection with the town of Munuʾ, which was located on (or near) the Patti-Enlil (see, respectively, *ibid.*, No. 90 and HARPER 1892-1914, No. 883). The region of Birat (and the Patti-Enlil) belonged to the governorate of Assur, which was administered at this time by Ṭāb-ṣil-Ešarra (PARPOLA 1987, No. 90).

169 PARPOLA 1987, No. 63; see also FALES 1993, 81-82 (81 n. 11 for the Patti-Enlil specifically).

Euphrates,[170] proving that the route was practicable. We tentatively identify the Patti-Enlil with one of the two lines of fossil meanders which cross the plain in a easterly/southeasterly direction from the Euphrates to the Tigris approximately midway between Dūr-Kurigalzu and Sippar (see Map 9). A junction of the southernmost of these two lines with the eastern stretch of the older Irnina would have been possible through the channel represented by the dashed line on our Maps 5 to 8 (compare Map 9).

Purattu, Araḫtu, and the Major Eastbank Canals from Sippar to Babylon (Map 9)

When Tukulti-Ninurta II reached Sippar-of-Šamaš in the early ninth century, after having previously crossed the Patti-Enlil south of Dūr-Kurigalzu, he states that he "took the way *towards* the Purattu," [171] a clear indication that the channel upon which Sippar was situated in the Old Babylonian period and earlier was no longer called by that name. Near the end of the eighth century, an inscription of Sargon II indicates that the countryside north of Babylon had lapsed from cultivation and that it had become a desert.[172] If Sargon's statement can be credited, a major dislocation had occurred in the water supply of this region. By the beginning of the ninth century the bulk of Euphrates flow had shifted to the old Araḫtum channel, which was now called the Purattu. Most of the region under study, therefore, had to be served now by artificial canals stemming from this line, the more important of which are first attested only later, during the era of the Neo-Babylonian dynasty.

Certainly in the late seventh century, the old bed of the Purattum from Abū Ḫabbah to Tell ed-Dēr (the 'Main Branch') was either dry or conducted little flow. Nabopolassar had to re-excavate the channel to Sippar and line it with baked-brick and bitumen because "the Purattu had moved far off." [173] The rejuvenated waterway became an artificially regulated canal,[174] which was called the Nār-šarri ('King's Canal') in Neo-Babylonian, Achaemenid, and Seleucid times,[175] and the N^{e}har-Malkā

[170] PARPOLA 1987, No. 63 r. 3-7.

[171] *ana pūt*(SAG) ÍD.*Pu*[*ra*]*tte aṣṣabat* (GRAYSON 1991, 174 : 54). Compare the use of *ana pūt* ÍD.*Puratte ṣabātu* in the section of the annals of Ashurnasirpal II describing his journey from Sūru, which was located on the Ḫabūr (*ibid.*, 176 : 97), some distance away (*ibid.*, 214 iii 28-29).

[172] GADD 1954, 192 vii 45-68 ; see COLE 1994, 87-88, and BRINKMAN 1995, 26-27.

[173] LANGDON 1912, 64 No. 2. There are no known dated economic documents from Abū Ḫabbah between Samsuditana year 22 (see GASCHE 1989, 113 and Plan 8) and 675 BC (see UNGNAD 1908, No. 2). After this long hiatus, significant documentation begins again only under Kandalānu, in the third quarter of the seventh century (BRINKMAN and KENNEDY 1983, 39-52).

[174] GASCHE 1988, 43.

[175] JURSA 1995, 204-205 ; VAN DER SPEK 1992, 237, nn. 9-10 ; and OELSNER 1986, 403, n. 551. The canal is attested for the first time (at least according to the published documentation) in Nabonidus year 10 (STRASSMAIER 1889a, No. 483 : 7).

thereafter.[176] According to a text dated to the 10th year of Nabonidus, the Nār-šarri came close to and perhaps even joined the Tigris,[177] much as the old Main Branch of the Purattum had done in the first half of the second millennium.

Besides the Nār-šarri, another major canal, called the Nār-Šamaš, is attested in documents from Sippar beginning in the late seventh century.[178] It flowed directly eastward from the left bank of the Purattu, leaving the river just below Sippar,[179] and followed a course that seems to have coincided with that of the waterway designated *tappištum* on the much older map of the region.[180] The Nār-Šamaš, like the Nār-šarri, was an artificial canal, which is proven by the existence of a sluice-gate at its opening.[181] A watercourse designated *ḫarīṣu* ('cutoff') left the Nār-šarri near one of Sippar's city-gates and joined the Nār-Šamaš,[182] apparently near the latter's point of departure from the Purattu.[183] This watercourse could have made use of the relief which later became the alignment followed by the canal whose imposing remains are still visible along the southwest side of Sippar (see Map 9).

According to GIBSON (1972, 50), in the Neo-Babylonian period there was apparently much settlement along the old channel through Kutha, with several new towns established along it.[184] This was also now an artificial watercourse. Nebuchadnezzar claims in several inscriptions that he worked on the quay of the 'Kutha Canal' (*ḫirīti* GÚ.DU$_8$.A.KI) in connection with his work on Emeslam, the temple of Nergal at Kutha.[185] We can assume, therefore, that other attestations of either the 'Kutha Canal' [186] or the 'Old Kutha Canal' [187] in Neo-Babylonian and Achaemenid-period

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176 OBERMEYER 1929, 163-164, and map *in fine* ("Babylonien im Zeitalter des Talmuds und des Gaonats").

177 STRASSMAIER 1889a, No. 483 : 7-8. Note that in the early second century BC, Seleucia was said to be on both the Nār-šarri and the Tigris (SACHS and HUNGER 1989, 385 No. -181 r. 9-10, 415 No. -178 r. 22', and 441 No. -171 B upper edge).

178 The date of the first attestation of Nār-Šamaš in texts published thus far seems to be Nabopolassar year 18 (PINCHES 1898, 14d).

179 Compare JURSA 1995, 204.

180 Published in THOMPSON 1966, Pl. 49, and republished by L. De Meyer in GASCHE and DE MEYER 1980, 6 (on the Old Babylonian origins of this map, see n. 114 above). A Neo-Babylonian attestation of the term *tappištum* is found in PINCHES 1982a, No. 768 : 6.

181 PINCHES 1982, No. 403 : 3-4.

182 STRASSMAIER 1889a, Nos. 351 and 781 ; *idem* 1890, No. 92; BM 67096; etc. (JURSA 1995, 66-70, and M. Jursa, personal communication).

183 The gardens of the *rab banê* which are said by Jursa to have been located on the Purattu and *ḫarīṣu* at the beginning of the reign of Nebuchadnezzar and on the Nār-Šamaš and *ḫarīṣu* afterwards (JURSA 1995, 66-70, and 205 s.v. Purattu) may have been situated at the point where all three watercourses joined. It is not necessary, therefore, to assume that the Purattu was later called the Nār-Šamaš.

184 Most of these settlements, however, are situated on appendages of the main levee (see Map 9).

185 LANGDON 1912, 108 ii 56 ; 170 B vii 59 ; 182 ii 51.

186 ÍD.GÚ.DU$_8$.A.KI or ÍD.*Ku-te-e*.

187 ÍD.GÚ.DU$_8$.A.KI *la-bi-ri* or ÍD.*Ku-te-e la-bi-ri*.

documents also refer to the canal through Kutha repaired by Nebuchadnezzar. But the texts mentioning the 'Old Kutha Canal' are all dated at Babylon,[188] and several of them even state explicitly that it was located opposite the Ištar Gate;[189] therefore this was not the canal flowing past the city of Kutha itself, leaving the 'Kutha Canal' as the only possible candidate. The latter is attested both in texts from the region of Babylon[190] and in documents from Nippur.[191] It is possible that the texts from the region of Babylon refer to estates held by local elites along the canal through Kutha,[192] especially along its uppermost course, close to where it left the Purattu some 32 km north of the capital. This location would generally agree with the testimony of later Arab geographers and others, who situate Kutha on the N^{e}har Kūthā, as expected, and locate the mouth of the canal three parasangs below the N^{e}har Malkā.[193] The fact that the 'Kutha Canal' occurs in the same context as the Tigris in PINCHES (1982b, No. 207: 2'-6') also argues against locating the former near Babylon during NB-Achaemenid times. A 'Kutha Canal' is also attested in Murašû documents from Nippur.[194]

The main branch of the river from which the Kutha Canal originated, down through the capital and on to Dilbat,[195] was called the Purattu or ÍD.UD.KIB.NUN.KI in administrative documents and commemorative inscriptions, as well as the Araḫtu, the old name of the channel, in the royal inscriptions of some Neo-Assyrian and Neo-

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188 Attestations from the second half of sixth century through the early fifth include the following: STRASSMAIER 1889a, No. 973; *idem* 1890, Nos. 320, 323, 346; *idem* 1890a, No. 179; *idem* 1897, Nos. 171, 287; BM 59568. Attestations in texts dated elsewhere: *idem* 1890a, No. 217 (Paširi); *idem* 1897, No. 332 (KÁ ÍD.GÚ.DU$_8$.A.KI) and No. 426 (URU.ÍD.GÚ.DU$_8$.A.KI-*la-bi-ri*).

189 E.g., BM 59568: 1-2: *meḫrat abul* ^{d}*Ištar pīḫāt* TIN.TIR.KI (see GEORGE 1992, 341). It is topographically impossible that this canal flowed northeast from Babylon to Kutha, as VAN DRIEL has posited (1988, 126-127).

190 None are apparently dated at Babylon itself. Attestations (all second half of the sixth century) include: STRASSMAIER 1889a, No. 1102 (Bīt-šar-Bābili); *idem* 1897, No. 102 (Province of Babylon); and perhaps PINCHES 1982b, No. 207.

191 Attestations of the Kutha Canal in fifth-century texts from Nippur include: HILPRECHT and CLAY 1898, No. 106; CLAY 1904, Nos. 24, 50; *idem* 1912a, Nos. 12, 22, 83, 101, 215; DONBAZ and STOLPER 1997, No. 16.

192 Just as temple officials from Kutha could hold lands on the Purattu in the Seleucid period (CLAY 1912, No. 88). The 'king's outlet' (*mūṣû ša šarri*) and 'Babylon dam' (*kilâta ša* TIN.TIR.KI) mentioned in connection with ÍD.GÚ.DU$_8$.A.KI [*ša pīḫāt*?] TIN.TIR.KI in STRASSMAIER 1889a No. 1102, a text dated at Bīt-šar-Bābili, perhaps refer to canal works upstream where the Kutha Canal left the Purattu (contra UNGER 1970, 102). It is also possible that ÍD.GÚ.DU$_8$.A.KI is an abbreviation of ÍD.GÚ.DU$_8$.A.KI *la-bi-ri*, both here and in STRASSMAIER 1897, Nos. 102 and 332.

193 OBERMEYER 1929, 278-280, and map *in fine*. EL-SĀMARRĀIE (1972, map on p. 14) shows a more accurate trajectory for the N^{e}har Kūthā but places the mouth of the N^{e}har Malkā too far north.

194 ZADOK 1978, 279-280.

195 For evidence of the Purattu at Dilbat already in the ninth century, see BRINKMAN 1995, 23, and n. 40 (citing *VS* 1 No. 35). This is not a serious complication (as suggested by Brinkman), because the river was simply following the line which it had taken in the first half of the second millennium.

Babylonian kings.[196] Sometime before 702 BC a canal known as the Banītu was dug from the Purattu at Babylon to supply Kish,[197] which lay directly east of the capital, because the old north-south line through Kish had been discontinued.[198] It is uncertain whether this canal continued along the important levee which runs almost due east of Kish and then turns southeast. If so, the stretch east of the city may have been known by the old Sargonic name, 'River of Kish,'[199] which is mentioned in documents from Babylon dating between the mid-seventh and mid-sixth centuries.[200] It was undoubtedly along the levee of the Banītu Canal (and the stretch due east) that the later Shaṭṭ an-Nīl or Nᵉhar Sūrā flowed.[201]

Pallukkatu (Map 9)

A watercourse called the Pallukkatu is attested from the reign of Neriglissar on.[202] From the perspective of Sippar, the Pallukkatu was situated across the Purattu, that is, to the west of it.[203] This is proven by the mention of the village Āl(u-ša)-Šamaš *ša nēberti Puratti* in BM 63900, which can be identified with the Āl(u-ša)-Šamaš *ša ina muḫḫi Pallukkat* in STRASSMAIER 1889a, No. 448, etc.[204] Because of topographical constraints, the channel must have departed from the Purattu somewhere west of Sippar, but certainly not at Fallūğah as has been commonly suggested. Therefore it could only have followed the modern course of the Euphrates between the Iskandarīyah Terrace and the western desert.[205] We cannot yet determine precisely when the bed of the

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196 BRINKMAN 1995, 22. Araḫtu occurs in NB administrative documents only in reference to the toponym GARIM *Araḫtu* near Borsippa (see, e.g., COLE 1994, 107).

197 WALKER 1981, 64 No. 75 ; see BRINKMAN 1995, 22, and n. 29.

198 GIBSON 1972, 50.

199 Attested at Nippur (WESTENHOLZ 1975, No. 24 ii 7).

200 ÍD.KIŠ.KI or ÍD.URU.KIŠ.KI (CONTENAU 1927, No. 11 : 4, 6 ; STRASSMAIER 1889, No. 330 : 2 ; *idem* 1889a, No. 65 : 6 ; BM 36347 : 7 ; cited by BRINKMAN 1995, 22, n. 29). This may have been the offtake from the Banītu granted to Nippur by Sennacherib, which apparently was not functioning during the reign of his successor, Esarhaddon (see HARPER 1892-1914, No. 327). If this watercourse continued on to Nippur, it is probably to be identified with the Purat-Nippur, which is attested first in 527 BC and frequently thereafter (ZADOK 1978, 278-282).

201 OBERMEYER 1929, 283-284.

202 EVETTS 1892, Nos. 3, 4, and 70.

203 Contra VAN DRIEL (1988, 128), who states that "[a] left bank canal on the line of the Isa- or Saqlawiah-canal seems much more sensible..."

204 We owe this observation to M. Jursa, who kindly shared with us his knowledge of the Sippar landscape and also evidence from unpublished NB texts in the British Museum.

205 The specific area is shown on Map 9. This terrace is probably mentioned in a text from the reign of Nabonidus, which describes the upper course of the channel as extending "from the mouth of the Pallukkatu, as far as New Town, (and) as far as the mountain" (STRASSMAIER 1889a, No. 506 : 2-3).

Fig. 1. Aerial view of the large loop south of Seleucia illustrating the shift of river meanders. SPOT 1990.

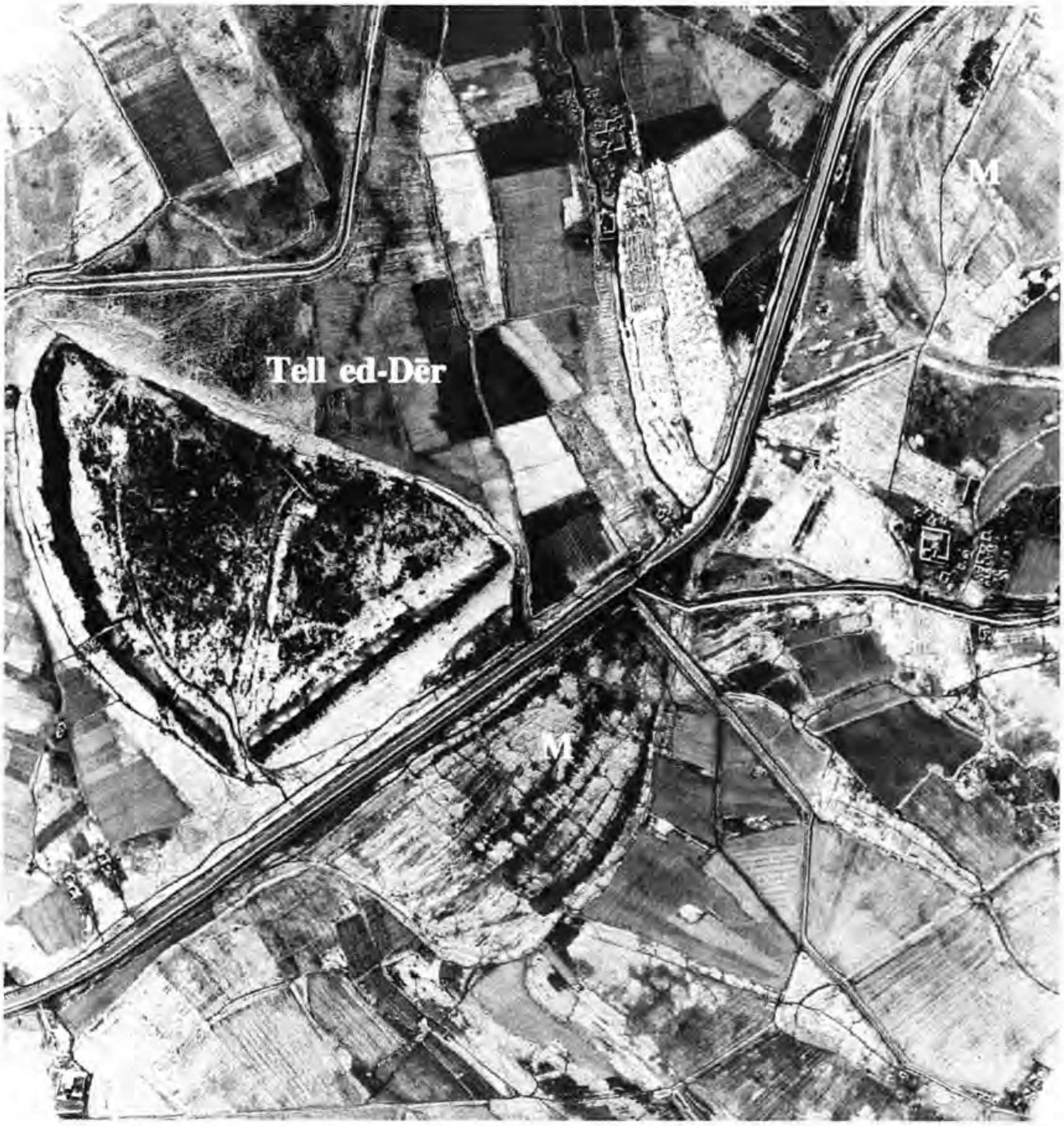


Fig. 2. Aerial view (1975) of two fossil meanders (M) — located southeast and northeast of Tell ed-Dēr — representing vestiges of the ancient Main Branch of the Euphrates. The meander southeast of ed-Dēr was investigated by BAETEMAN (1980, 18-20). Due to cultivation these features are nowadays visible only from above, but CHESNEY (1969, 56 and map VII), LOFTUS (1871, 15-16), and BEWSHER (1867, map after p. 161) could still detect these old channels in the field in the course of their survey activities (see also Figs. 3 and 4 of GASCHE and DE MEYER 1980).

Fig. 3. Aerial view of a typical system of disused irrigation canals that took off from the main channel lying on the levee of the old Main Branch of the Purattum (here south of Seleucia).

Fig. 4. Heads of disused irrigation canals near Sippar which tapped their water from a probable meander of the old Main Branch of the Purattum (or the canal which replaced it). See Map 4 for the location of this probable fossil meander NNW of Abū Ḥabbah/Sippar.

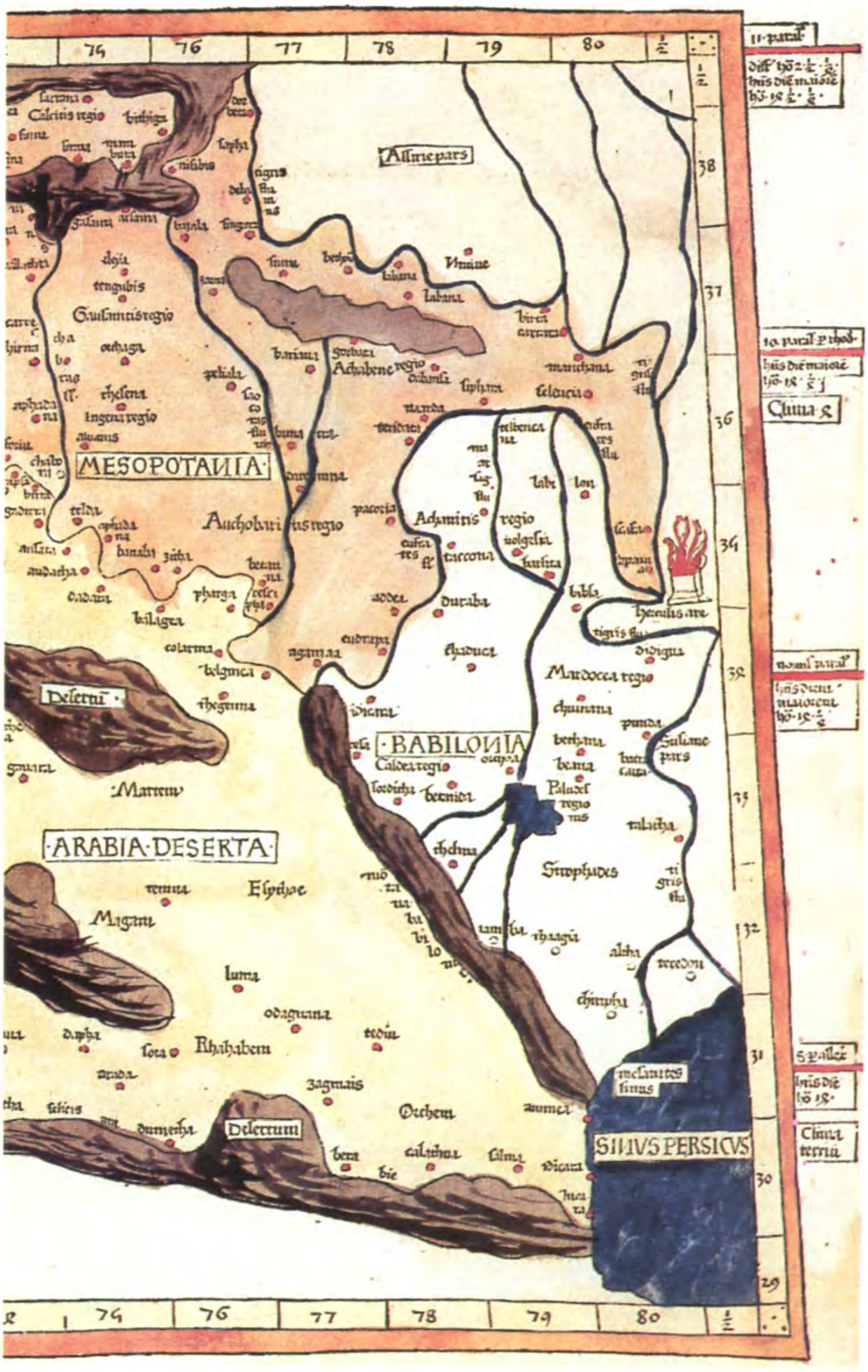


Fig. 5. Excerpt from Ptolemy's "Qvarta Asiae tabula continet Cyprum & Syrium & Iudea & Vtraq. Arabia petream & deserta ac Mesopotamia & Babilonia." From Ptolemy's *Cosmographia*, Ulm, 1482, Leonardus Holle; designed by the Benedictine monk Donnus Nicolaus Germanus. Compare Fig. 6 (see also n. 60 above).

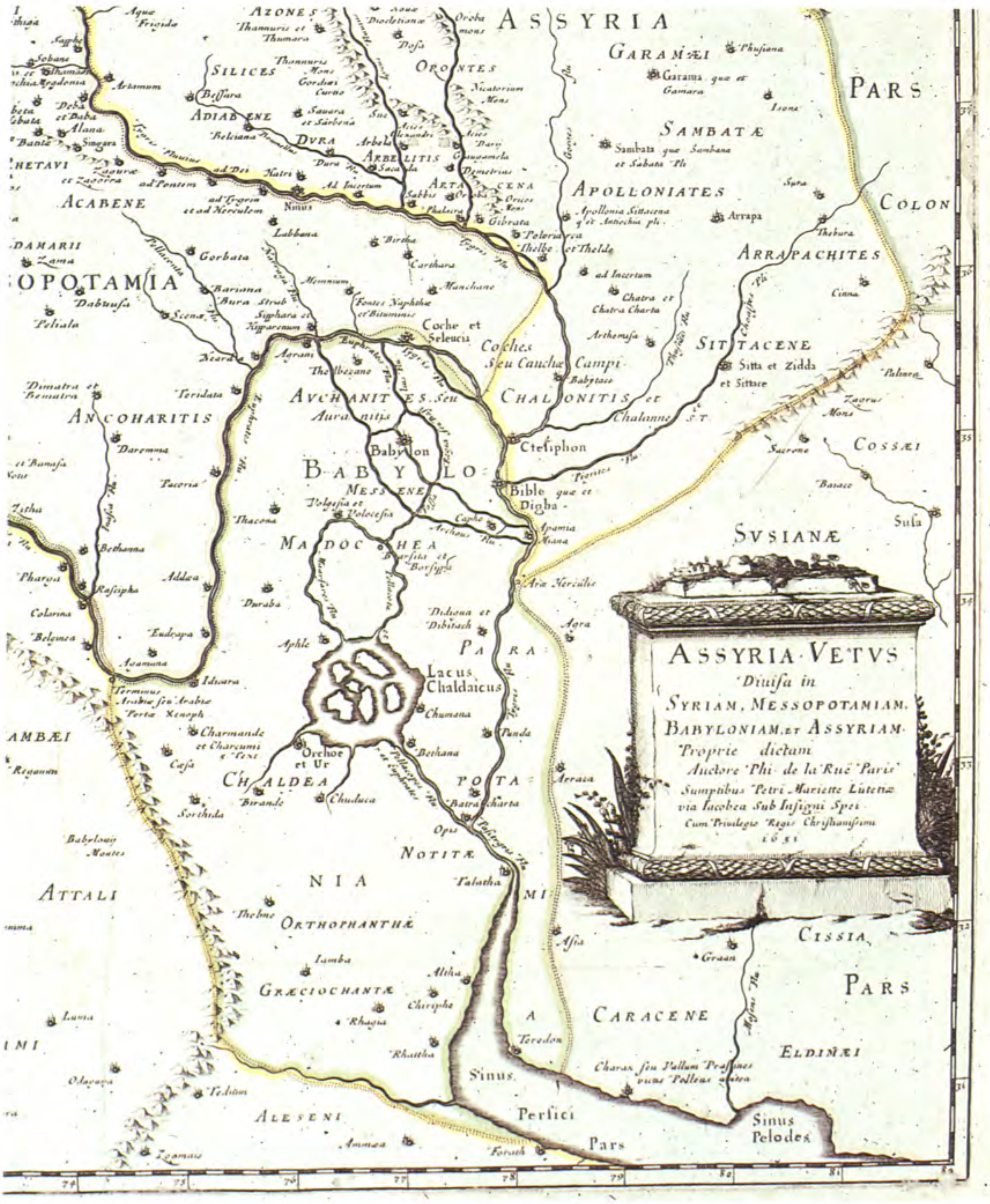
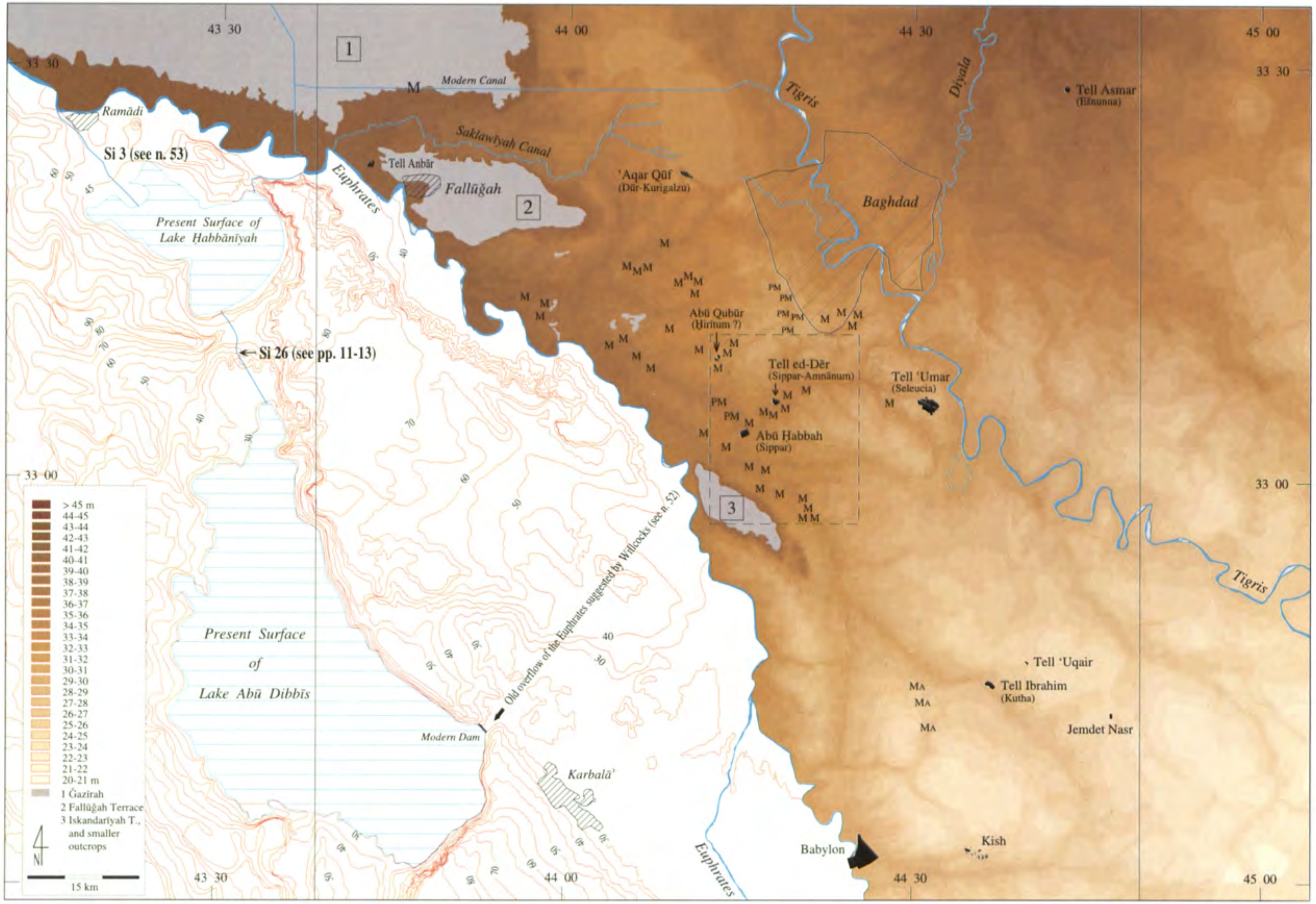
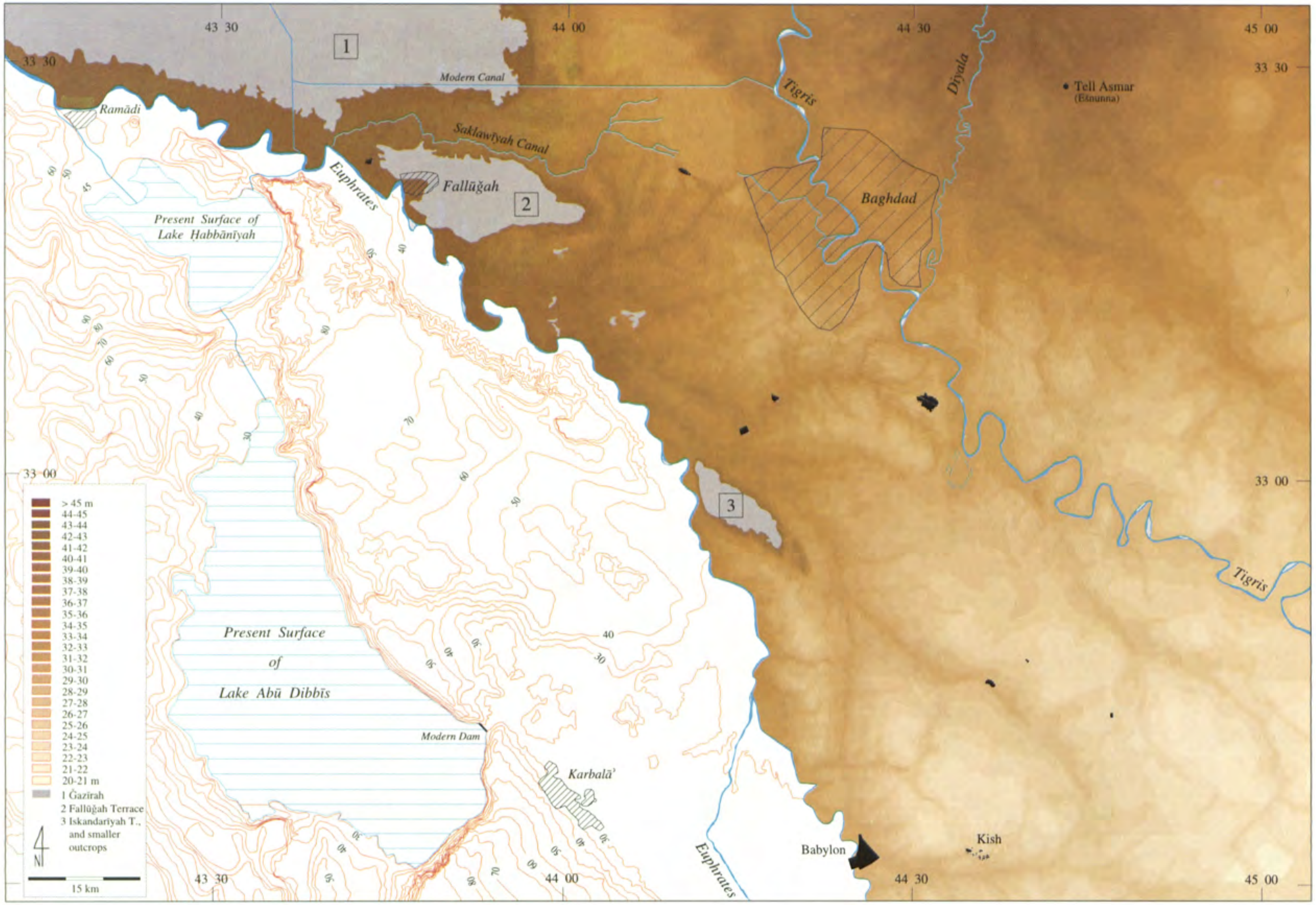


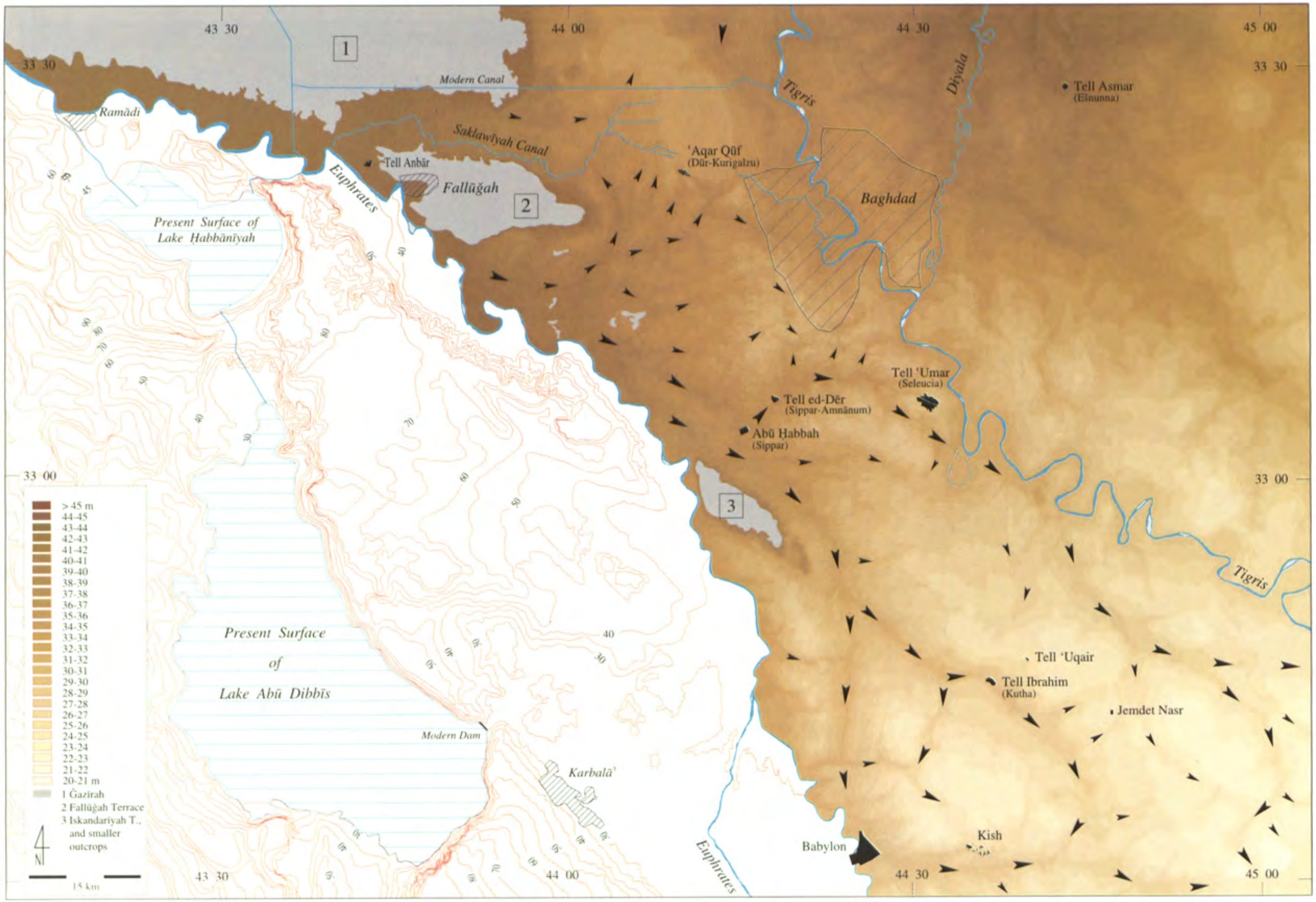
Fig. 6. Excerpt from Philippe de La Ruë's "Assyria Vetvs Diuisa in Syriam, Messopotamiam, Babyloniam et Assyriam," which was first published in 1651 as an addition to his Atlas "La Terre Sainte en six cartes géographiques." Note that the course of the Euphrates is divided into several branches and that this pattern of distribution is very similar to the one shown on our Maps 8 and 9. It should be noted that La Ruë's map does not reflect the geographical reality of the mid-17th century but rather a historical situation which has been reconstructed from older documents, of which Ptolemy's works (see Fig. 5) are probably the most important (see also n. 60 above).



Map 1. The system of levees in the project area and in the region E of the Tigris (agglomerating all periods). Various sources. The larger inset shows the area covered by Maps 5, 6, and 7, while the smaller one shows the area covered by Map 4. Interval contour lines W of the Euphrates : 5 m. M = fossil meander (Gasche) ; PM = probable fossil meander (Gasche) ; MA = meander mapped by ADAMS (1972, 201) ; because they require further investigation, not all the meanders mapped by ADAMS (1972) are shown here. Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.



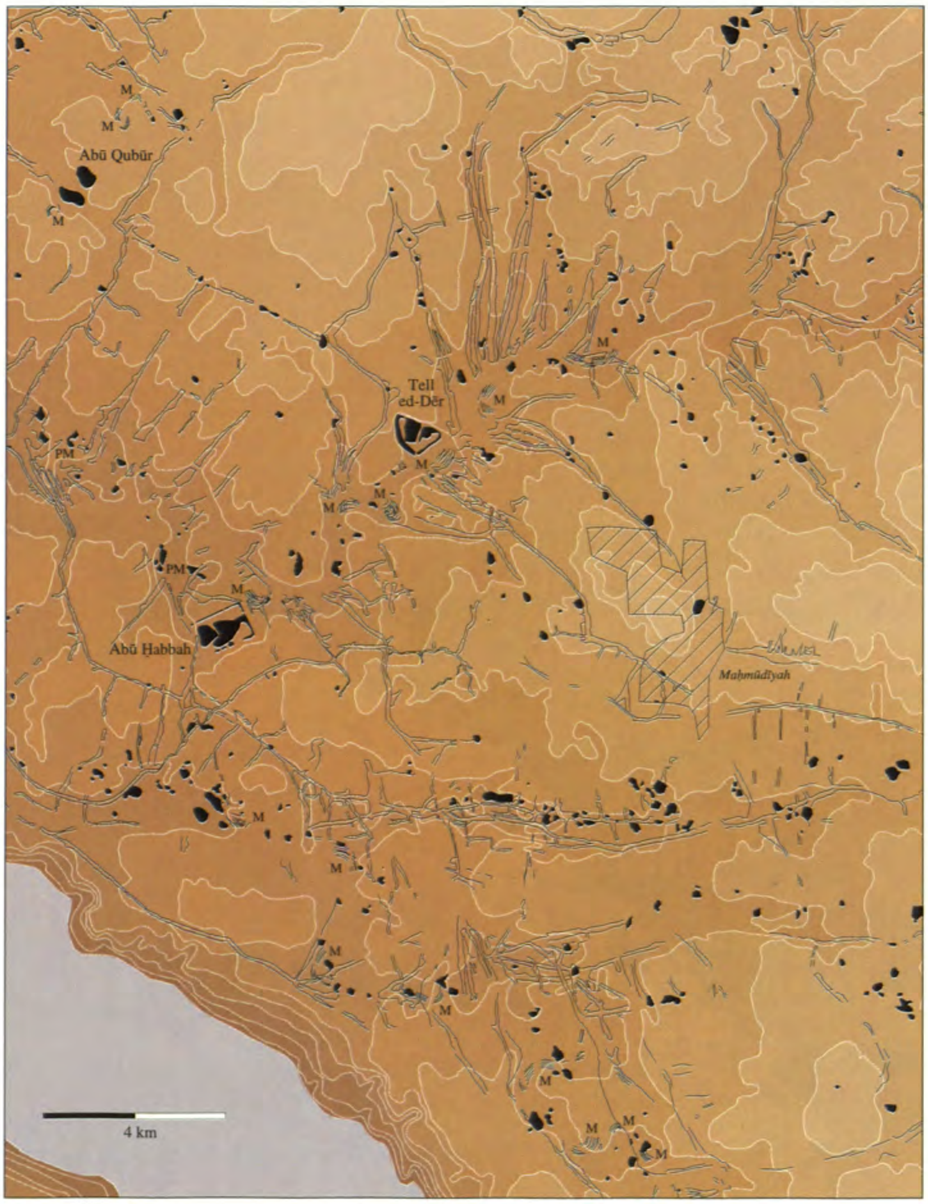
Map 2. The present drainage system in the project area according to Map 1. Interval contour lines W of the Euphrates : 5 m. Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.



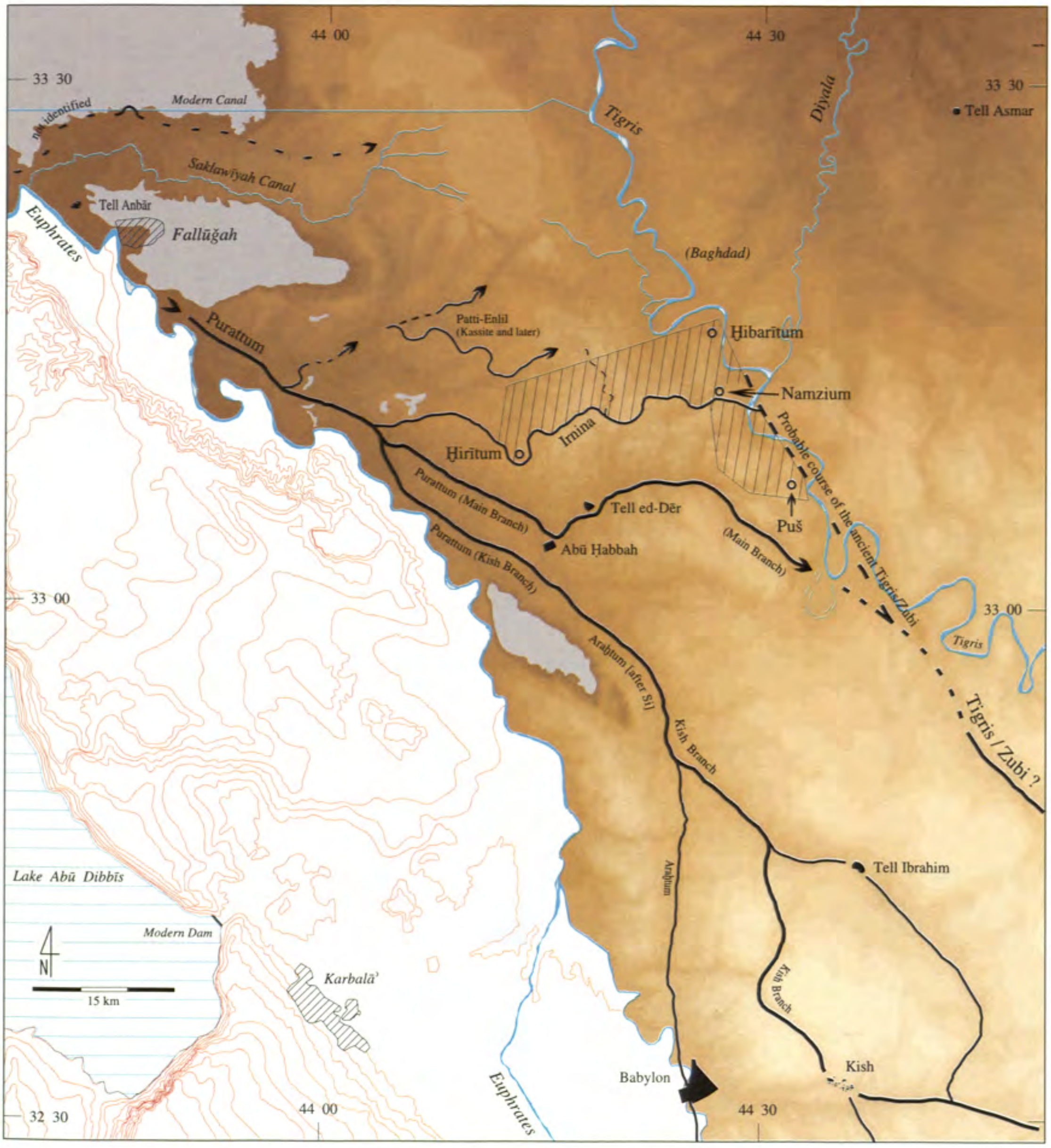
Map 2bis. The present drainage system with arrows indicating the direction of flow. Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.

Map 3. The project area with the system of levees (from Map 1) and the location of all known archaeological sites regardless of their periods of occupation, which extend from Ubaid to Islamic times (from unpublished surveys of the Belgian Arch. Exp. to Iraq, ADAMS 1972, and GIBSON 1972). Note the geographical relation between levees and sites, taking into account that a large percentage of settlements were not located directly adjacent to ancient river courses, but were spread over their levees, mainly along canals built upon them (see Map 4 for an illustration of this).

Only a few sites are located in the deeper part of the basins, but it should be noted that ancient settlements can be totally covered by alluvial sediments (Ra'sal-ʿAmiya, for ex. ; see also GEYER and SANLAVILLE 1996, 401). Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.

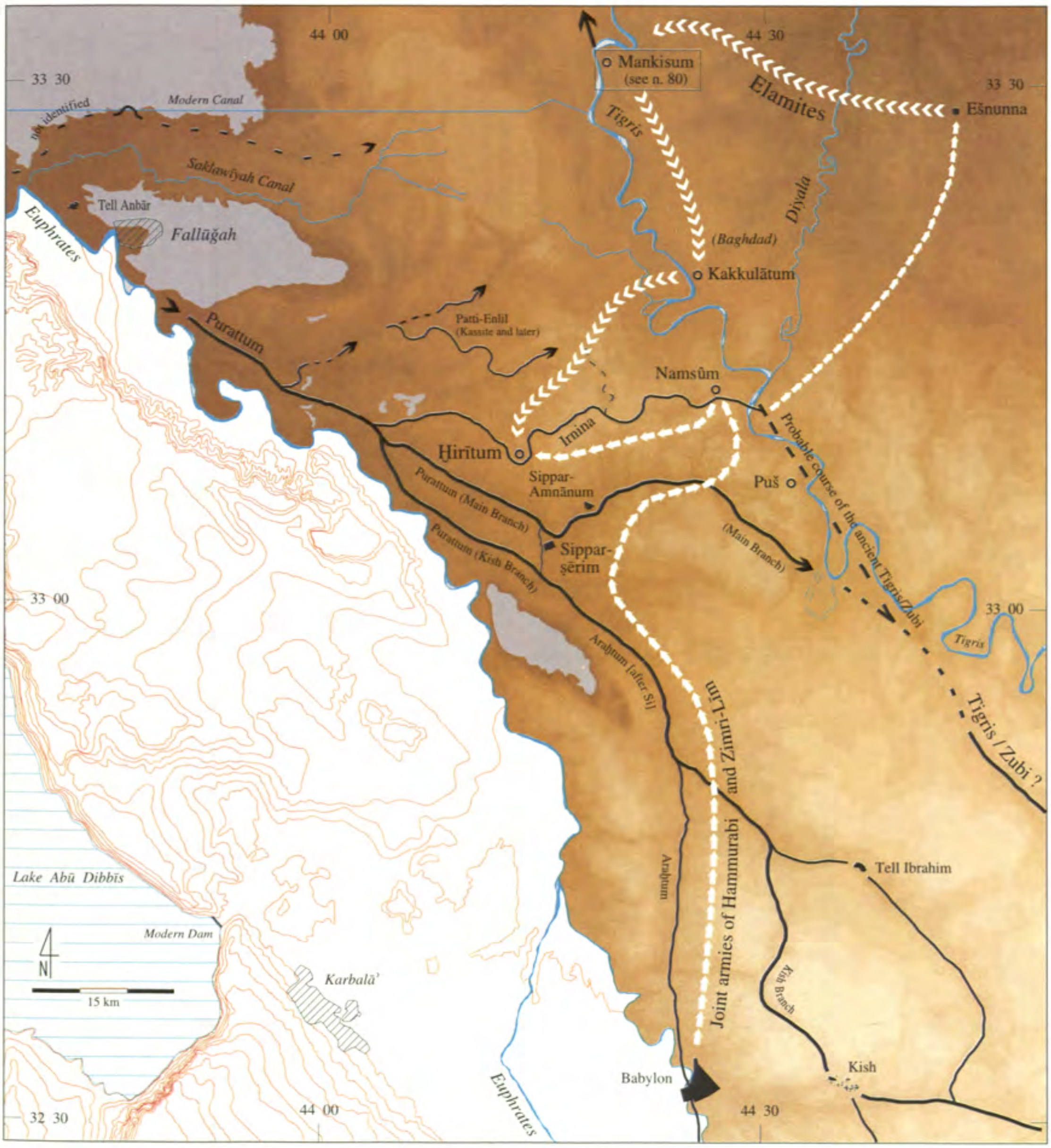


Map 4. Abandoned irrigation network and sites in the area of Abū Ḥabbah and Tell ed-Dēr (agglomerating all periods). One should take note of the 'wheat-ear' arrangement of the canals on either side of the levee upon which Tell ed-Dēr is found; the majority of these canals tapped their water from a meandering channel that belonged to one of the later stages of the old Main Branch of the Euphrates. According to the periods of occupation of the sites along them, some of them could have been in use already in the Achaemenid period, if not earlier. M = fossil meander; PM = probable fossil meander. Generated from a combined Microstation and Access database by K. Verhoeven; © IPA 4/25, Univ. of Ghent.



Map 5. Reconstruction of the district of Sîn according to the Cadastre of Ur-Nammu (KRAUS 1955, 46-47 A ii 24-iv 26), showing the principal toponyms of the district and their approximate locations (compare STEINKELLER 1980, 33). Concerning the reconstruction of the river lines, see the caption of Map 8. Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.

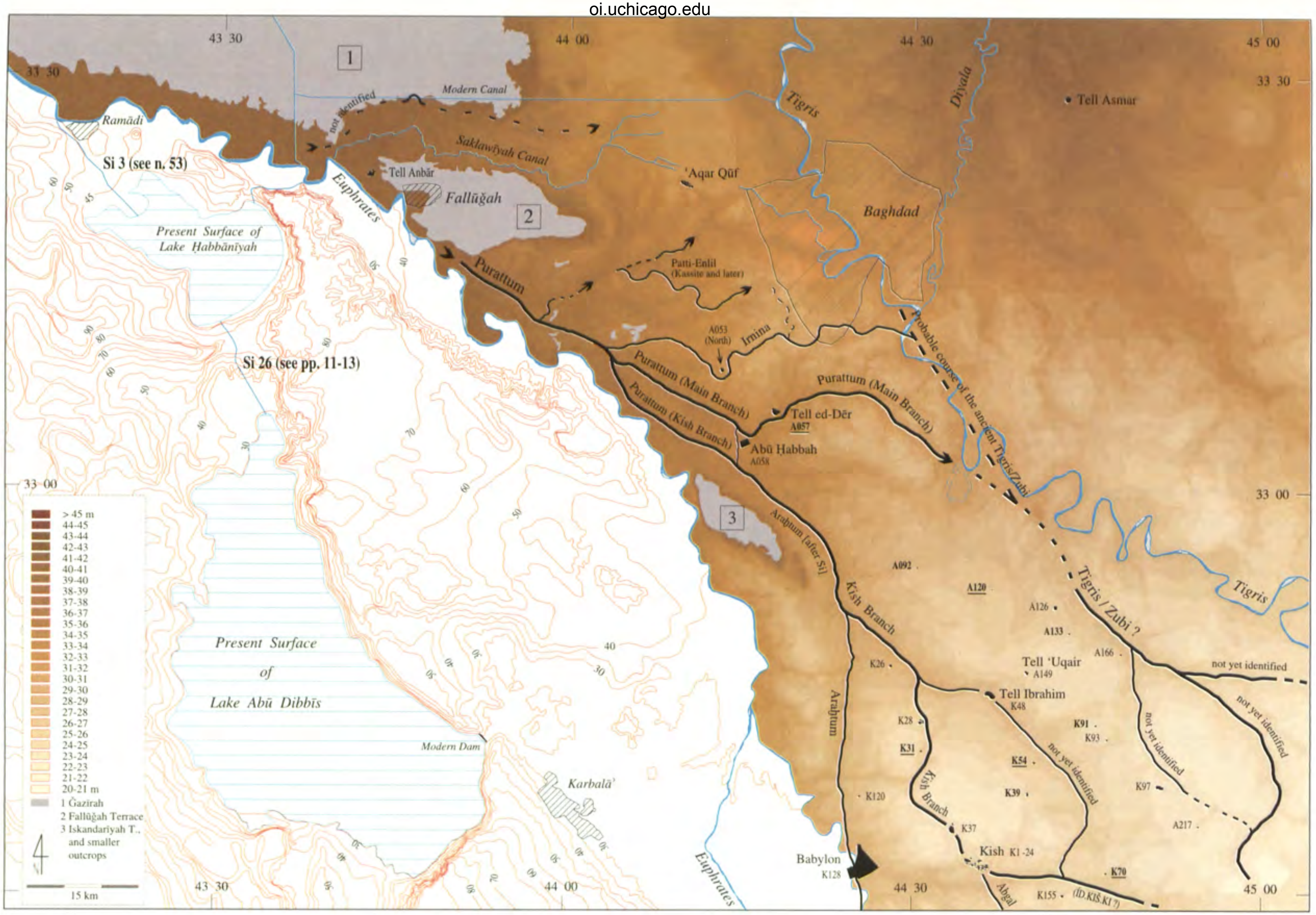
Map 6. Reconstruction of the Sippar(-ṣērim)-Mankisum segment of the Old Babylonian itineraries (GOETZE 1953, 51 i 11-19 ; HALLO 1964, 63 obv. 5-9). Concerning the reconstruction of the river lines, see the caption of Map 8. The waterway between the Main and Kish Branches of the Euphrates just west of Sippar-ṣērim is situated on a levee that may have been built up by a natural watercourse running here before the two branches bifurcated further to the northwest and is a feature that could well be represented on the OB map of Sippar and its vicinity published in GASCHE and DE MEYER 1980, 6, Fig. 3. Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.



Map 7. Principal toponyms mentioned in connection with the Battle of Ḫirītum during the time of Hammurabi and Zimri-Līm (compare LACAMBRE 1997). Concerning the reconstruction of the river lines, see the caption of Map 8. For the reconstructed watercourse just west of Sippar, see the remarks in the caption of Map 6. Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.

Survey No. K [1]	A [2]	*Site*	*Size*	*Occupation Periods*
-	-	T. Anbār	-	*Late Larsa, Old Babylonian*, Parthian/Sassanian and Islamic (DAMERGI 1986, 11)
-	A053	Abū Qubūr North	± 55 ha (North & South mounds, DE MEYER and GASCHE 1986, 6)	Akkadian (probably less than 1 ha), *Ur III (?), Isin-Larsa* (DE MEYER and GASCHE 1986, 20-23); Neo-Babylonian (mixed with earlier material) is only attested in a water deposited sandy/gravelly thick layer found at the southern edge of the North Mound.
-	**A057**	**T. ed-Dēr** (Sippar-Amnānum)	± 50 ha (GASCHE 1986, 56)	*Ur III to Old Babylonian* (GASCHE 1978; 1984; 1989), Kassite (*idem* 1991), Neo-Babylonian (not yet attested in excavations, but see LANGDON 1915, 114-115 iii 26-69 for the reconstruction of the É.UL.MAŠ by Nabonidus). Seleucid (GASCHE 1996a), Parthian/Sassanian (*idem* 1978, 108-119), and later graves.
-	A058	Abū Ḥabbah (Sippar)	± 96 ha (DE MEYER and GASCHE 1980, 29)	Uruk (ADAMS 1972, 192), ED through Akkadian (cf. AL-JADIR 1986 and SCHEIL 1902, 24), *Ur III* (not yet attested in excavations, but see *RGTC* 2, 168-169), *Isin-Larsa, Old Babylonian* (AL-JADIR 1986), Kassite (recent unpublished Iraqi excavations). Neo-Babylonian (for Rassam's activities, see now WALKER and COLON 1980; for summaries of the new Iraqi excavations, see AL-JADIR 1986 and 1991), Achaemenid, limited Seleucid and Parthian remains, Sassanian and Islamic graves (HAERINCK 1980).
-	**A092**	**No name**	60 diam. x 2 (ADAMS 1972, 194)	Uruk, ED-Akkadian (?), *Isin-Larsa* (ADAMS 1972, 194).
-	**A120**	**Ishân Muqfayshah***	120 diam. x 2.5 m (ADAMS 1972, 195)	Main occupation from OB (?) or slightly earlier times to *Neo-Babylonian*, continuing on a limited scale to Parthian times (ADAMS 1972, 195).
-	A126	Tabor Arasi*	500 x 400 x 2 m (ADAMS 1972, 195)	Uruk (?), ED III (?), Akkadian, *Ur III, Isin-Larsa, Old Babylonian* (ADAMS 1972, 195).
	A133	**T. Shegra***	60 diam. x 0,5 (ADAMS 1972, 196)	Uruk (?), *Isin-Larsa, Old Babylonian*, Kassite (ADAMS 1972, 196).
-	A149	T. 'Uqair*	-	Ubaid to ED, minor re-occupation in *OB (?)* and Kassite times (ADAMS 1972, 198-199).
-	A166	Ishân Hamîd*	Min. 150 diam. x 7 m (ADAMS 1972, 200)	Uruk (clay sickle fragments only), Akkadian, *Ur III, Isin-Larsa, limited OB (?)* (ADAMS 1972, 200).
-	A217	Shcutha*	100 diam. x 1 m (ADAMS 1972, 204)	Uruk, ED (?), Akkadian, *Ur III, Isin-Larsa*, Islamic (ADAMS 1972, 204).
K1-24	-	Kish	± 255 ha [3]	Ubaid (MOOREY 1979, 164), Uruk through Akkadian, *Ur III, Isin-Larsa, Old Babylonian*, Kassite through Post-Ilkhanid (GIBSON 1972, 118-122).
K26	(A078)	T. Nimrud*	200 x 200 x 5 m	ED III (?), Akkadian, *Ur III, Isin-Larsa, Old Babylonian*, insignificant Islamic occupation. For the location of the site, see ADAMS 1972, Map 1C (not GIBSON 1972, Fig. 10).
K28	(A181)	T. Murhish*	Complex of mounds covering an area of ± 1000 x 750 m	Ubaid through Akkadian, *Ur III, Isin-Larsa, Old Babylonian*, Achaemenid/Seleucid, Early Islamic to Late Abbasid.
K31	(A182)	**Abū Dhibah***	100 x 100 x 2 m	*Ur III/Isin-Larsa, Old Babylonian.*
K37	(A195)	Ishān Mizyad*	1000 x 600 x 4 m	End of 4th-beginning of 3rd millennium (MAHDI 1986). Akkadian, *Ur III, Isin-Larsa, Old Babylonian*, Kassite (GIBSON 1972, 125).
K39	(A193)	**Abū Ajrash***	300 x 200 x 4 m	Uruk, *Old Babylonian*, Kassite to Parthian.
K48	(A140)	T. Ibrahim* (Kutha)	± 2000 x 1000 x 8 m (Main mound)	Uruk through Akkadian, *Ur III, Isin-Larsa, Old Babylonian*, Kassite through Late Abbasid.
K54	(A191)	**Tell Khalfat***	100 x 120 x 1 m (Main mound)	*Isin-Larsa, Old Babylonian*, Kassite to Achaemenid/Seleucid.
K70	-	**Ishān al-Kharah***	250 x 250 x 5.5 m (Mound a)	*Old Babylonian*, Parthian, Sassanian, and some Early Islamic.
K91	(A202)	**No name**	230 x 150 x 2.5 m (ADAMS 1972, 202)	Uruk (?), *Old Babylonian*, Kassite.
K93	(A204)	Jemdet Ubaid*	200 x 170 x 4 m (ADAMS 1972, 203)	Uruk, ED (?), Akkadian, *Isin-Larsa, Old Babylonian*, Kassite.
K97	(A213)	Umm al-Jīr*	700 x 300 x 4.5 m	Uruk through Akkadian, *Ur III, Isin-Larsa, Old Babylonian*, Achaemenid/Seleucid and Parthian (graves ?), Late Abbasid and Post Ilkhanid.
K120	-	Abū Hejjīl*	200 x 100 x 5-6 m	Akkadian, *Ur III, Isin-Larsa*, Parthian and Sassanian.
K128	-	Babylon	± 975 ha [4]	Not collected systematically. ED III, Akkadian, *Ur III, Isin-Larsa, Old Babylonian*, and Kassite through Late Abbasid.
K155	(A200)	Ishān Khalfa*	200 x 150 x 4 m (Higher mound of the group)	*Old Babylonian (??)*, Kassite to Parthian.

* Orthography used by ADAMS (1972) and/or GIBSON (1972).
1) Kish Survey (GIBSON 1972). When a site was visited by both Adams and Gibson, we cite the data of Gibson.
2) Akkad Survey (ADAMS 1972).
3) GIBSON's (1972) sites No. 1 to 24 (including the areas between them) cover about 255 ha. The group of tells constituting site No. 25 (Ishan al-Khazna, Islamic), covers another 8.5 ha.
4) The largest extension in Neo-Babylonian times (outer city-wall including Babil [= Gibson's No. 127]) cover 975 ha, cf. GASCHE and DE MEYER 1986.



Map 8. The river network of northern Babylonia in the first half of the second millennium BC (compare Map 10). Most of the river lines are drawn schematically according to the location of the identified fossil meanders (see Map 1). For the reconstructed watercourse just west of Sippar, see the remarks in the caption of Map 6. Sites with initial occupations dated by ADAMS (1972) to the Old Babylonian period are not mapped here (see nn. 2 and 10). The sites shown are those surveyed by Adams and/or Gibson, unless otherwise stated. Generated from a combined Microstation and Access database by K. Verhoeven; © IPA 4/25, Univ. of Ghent.

<u>057</u> = Site probably founded during Ur III, Isin-Larsa, or Old Babylonian times.

092 = Site re-occupied during Ur III, Isin-Larsa, or Old Babylonian times after a long gap.

053 = Site occupied more or less continuously before and during Ur III times, as well as during Isin-Larsa and/or Old Babylonian times.

Survey No. K[1]	A[2]	*Site*	*Size*	*Occupation Periods*
-	-	**T. Aswad**	-	*Neo-Babylonian* (AKRAM AL-ZEEBARI 1982), Parthian and Sassanian (AKHMAD MALEK AL-FATYAN and ZOHAYR RADJAB ABDOLLAH 1979).
-	-	**Median Wall** (Ḥabl aṣ-Ṣaḫr)	-	*Neo-Babylonian* (BLACK *et al.* 1987 ; GASCHE 1989a).
-	-	**HB5**	-	*Neo-Babylonian* and later (BLACK *et al.* 1987, 15).
-	**A053**	**Abū Qubūr South**	± 55 ha (North & South mounds, DE MEYER and GASCHE 1986, 6)	*Neo-Babylonian* (ADAMS 1972, 192 ; BLACK *et al.* 1987, 14 ; see also BRUSCHWEILER 1989), Achaemenid (summary in GASCHE 1991a), Seleucid, Parthian (WARBURTON 1991, GASCHE and PONS 1991), limited Islamic occupation.
-	**A055**	**T. al-Ḥargāwī**	± 8 ha	*Neo-Babylonian*, Achaemenid (ADAMS 1972, 192), Seleucid (unpublished survey ; see also AMANDRY 1991).
-	A057	T. ed-Dēr (Sippar-Annunītu)	± 50 ha (GASCHE 1986, 56)	Ur III to Old Babylonian (GASCHE 1978 ; 1984 ; 1989), Kassite (*Idem* 1991), *Neo-Babylonian* (not yet attested in excavations, but see LANGDON 1915, 114-115 iii 26-69 for the reconstruction of the É.UL.MAŠ by Nabonidus). Seleucid (GASCHE 1996a), Parthian/Sassanian (*idem* 1978, 108-119) and later graves.
-	A058	Abū Ḥabbah (Sippar)	± 96 ha (DE MEYER and GASCHE 1980, 29)	Uruk (ADAMS 1972, 192), ED through Akkadian (cf. AL-JADIR 1986 and SCHEIL 1902, 24), Ur III (not yet attested in excavations, but see *RGTC* 2, 168-169), Isin-Larsa, Old Babylonian (AL-JADIR 1986), Kassite (recent unpublished Iraqi excavations), *Neo-Babylonian* (for Rassam's activities, see now WALKER and COLON 1980 ; for summaries of the new Iraqi excavations, see AL-JADIR 1986 and 1991), Achaemenid, limited Seleucid and Parthian remains, Sassanian and Islamic graves (HAERINCK 1980).
-	A060	Maḥmūdīyah	6 ha at least (GASCHE 1996, 3)	OB (?), Kassite (ADAMS 1972, 192 ; but see also GASCHE 1996, 3), *Neo-Babylonian*, Achaemenid (ADAMS 1972, 192 ; GASCHE 1996 summarizes recent excavations on this site), and later graves.
-	**A064**[3]	**No name**	200 diam. x 2.5 m	Uruk (?), Akkadian (?), *Neo-Babylonian*, Achaemenid.
-	**A067**	**No name**	100 x 25 x 3.5 m	Uruk (?), OB (?), *Neo-Babylonian* to Parthian.
-	**A070**	**No name**	170 x 100 x 1.7 m	Uruk, ED I, *Neo-Babylonian*, Achaemenid.
-	A072	T. al-Umfuggar *	± 500 diam. x 8 m	OB (?), Kassite, *Neo-Babylonian* to Parthian.
-	A073	No name	500 x 200 x 2.5 m	Uruk (?), Kassite (?), *Neo-Babylonian*, Achaemenid and later (?).
-	**A077**	**T. Itwaybah** *	± 500 diam.	*Neo-Babylonian*, Achaemenid to Parthian.
-	**A079**	**No name**	Large number of individual mounds	*Neo-Babylonian* to Parthian, (scattered OB ?).
-	**A096**	**T. al-Habbis al-Sharqi** *	200 diam. x 7.5 m (North M.)	Primarily *Neo-Babylonian*.
-	**A099**	**T. Suraysur** *	± oval 200 m	Uruk, *Neo-Babylonian*, Achaemenid.
-	A107	No name	8 individual small mounds	OB (?), Kassite, *Neo-Babylonian*, Achaemenid.
-	**A108**	**No name**	9 individual small mounds	*Neo-Babylonian*, Achaemenid.
-	**A117**	**No name**	3 small tells	*Neo-Babylonian*, Achaemenid.
-	A118	No name	220 x 120 x 2.5 m	OB (?), Kassite to *Neo-Babylonian*.
-	A120	Ishân Muqfayshah *	120 diam. x 2.5 m	Main occupation from OB (?) or slightly earlier times to *Neo-Babylonian*, continuing on a limited scale to Parthian times.
-	**A121**	**No name**	80 diam. x 3 m	*Neo-Babylonian*, Achaemenid.
-	**A122**	**T. Abû Gubub** *	300 x 200 x 7 m	*Neo-Babylonian*, Achaemenid.
-	**A123**	**T. al-Zibbentari** *	200 diam. x 5 m 500 x 200 x 3.5 m (S)	Mainly *Neo-Babylonian*, Achaemenid, perhaps continuing into Parthian times at southern end of South mound.
-	A129	T. Humadi *	250 diam. x 6 m	OB (?) to *Neo-Babylonian*, Achaemenid.
-	A134	No name	100 diam. x 1.5 m	Kassite, *Neo-Babylonian* to Parthian.
-	**A135**	**Ishân Angur Zuraybah** *	500 x 200 x 8 m 150 diam. x 6 m	*Neo-Babylonian*, Achaemenid (ADAMS 1972, 196).
-	A142	No name	± 150 diam.	Kassite, *Neo-Babylonian*.
-	A144	No name	200 diam. x 6 m and 2 outliers	Kassite, *Neo-Babylonian* to Parthian.
-	A145	No name	3 small mounds	Uruk, Kassite, *Neo-Babylonian* to Parthian, Islamic.
-	A148	No name	3 small mounds	OB (?), Kassite, *Neo-Babylonian*, Achaemenid to Parthian.
-	**A155**	**No name**	110 x 80 x 2.5 m 100 diam. x 2.5 m	*Neo-Babylonian*, Achaemenid.
-	**A157**	**Khayt Jed'an** *	150 diam. x 6 m	*Neo-Babylonian* to Parthian.
-	**A158**	**T. Meli'ah** *	140 x 50 x 2.5 m	*Neo-Babylonian*.
-	**A159**	**No name**	180 x 40 x 3 m	*Neo-Babylonian*, Achaemenid
-	**A160**	**No name**	120 diam. x 3 m	*Neo-Babylonian*, Achaemenid.
-	A163	T. Abdullah *	250 diam. x 5.5 m	Kassite, *Neo-Babylonian*, Achaemenid.
-	**A164**	**T. Resâsi Kabîr al-Sharqi** *	220 x 180 x 6 m	*Neo-Babylonian* to Parthian.
-	**A165**	**T. Abû Dhaba'** *	700 x 200 x 3.5 m	*Neo-Babylonian*, Achaemenid, limited Parthian.
-	A206	No name	130 x 80 x 1 m	OB (?) to *Neo-Babylonian*, Achaemenid.
-	**A214**	**No name**	250 diam. x 4-5 m	*Neo-Babylonian*.
-	**A218**	**T. Mahari Ismayan** *	400 x 200 x 8 m	*Neo-Babylonian*.
-	A219	No name	Many minor summits may extend for more than 500 m	Uruk, OB (?), Kassite, *Neo-Babylonian*, Achaemenid, Islamic.
K1-24	-	Kish	± 255 ha[4]	Ubaid (MOOREY 1979, 164), Uruk through Kassite, *Neo-Babylonian*, Achaemenid through Post-Ilkhanid.
K30	(A183)	**No name**	-	Ubaid or Uruk, *Neo-Babylonian*, Achaemenid/Seleucid.
K32	(A184)	No name	250 x 150 x 3 m	Primarily Uruk to ED III, Kassite, *Neo-Babylonian*, Achaemenid/Seleucid.
K39	(A193)	T. Abū Ajrash *	300 x 200 x 4 m	Uruk (?), Old Babylonian, Kassite, *Neo-Babylonian* to Parthian.
K48	(A140)	T. Ibrahim * (Kutha)	± 2000 x 1000 x 8 m (Main mound)	Uruk through Kassite, *Neo-Babylonian*, Achaemenid through Late Abbasid.
K54	(A191)	T. Khalfat *	100 x 120 x 1 m (Main mound)	Isin-Larsa to Kassite, *Neo-Babylonian*, Achaemenid/Seleucid.
K57b	(A194)	**Abū Biyāriq** *	150 x 300 x 2.5 m (Mound b)	*Neo-Babylonian* to Parthian, with Sassanian traces.
K61	(A212)	**T. al-Daym** *	250 x 150 x 5.5 m	*Neo-Babylonian* to Achaemenid/Seleucid.
K63	-	**No name**	200 x 250 x 1.5 m	*Neo-Babylonian*, Sassanian, limited Late Abbasid.
K64b	-	No name	± 1000 x 50 x 1-1.5 m	*Neo-Babylonian* (?), Parthian (?), and Sassanian.
K66	-	**No name**	150 x 150 x 2.5 m	*Neo-Babylonian*, Sassanian.
K80	-	No name	200 x 150 x 3-4 m	ED III, Kassite, *Neo-Babylonian*, Achaemenid/Seleucid.
K82b-c	-	**No name**	200 x 250 x 2.5 m (b) 100 x 100 x 1.5 m (c)	*Neo-Babylonian*, Achaemenid/Seleucid.
K94	(A205)	**Barghuthiat** * (Girumu)	-	*Neo-Babylonian*, Achaemenid to Late Abbasid.
K109	(A216)	Chebab an-Nahr *	150 x 70 x 3-4 m	Uruk, *Neo-Babylonian*, Achaemenid/Seleucid.
K115	(A170)	**Abū Rothan** *	100 x 200 x 5 m	*Neo-Babylonian*, Achaemenid to Parthian, slight Islamic occupation.
K122	(A174)	**T. al-Egrainy** *	150 x 150 x 9-10 m	*Neo-Babylonian*, Sassanian.
K127	-	Babil *	[5]	ED to Old-Babylonian sherds may indicate an earlier occupation. *Neo-Babylonian* to Parthian ; Sassanian sherds rare.
K128	-	Babylon	± 975 ha[5]	Not collected systematically. ED III through Kassite, *Neo-Babylonian*, Achaemenid through Late Abbasid.
K148	-	**Umm al-Aulad** *	400 x 150 x 5 m	ED III to Akkadian, *Neo-Babylonian* to Seleucid, Late Abbasid and Ilkhanid.
K155	(A200)	Ishān Khalfa *	200 x 150 x 4 m (Higher mound of the group)	Old Babylonian (?), Kassite, *Neo-Babylonian*, Achaemenid to Parthian.
K160	-	**No name**	100 x 100 x 2 m	*Neo-Babylonian* to Achaemenid/Seleucid.

- * Orthography used by ADAMS (1972) and/or GIBSON (1972).
1) Kish Survey (GIBSON 1972). When a site was visited by both Adams and Gibson, we cite the data of Gibson.
2) Akkad Survey (ADAMS 1972).
3) All data that concern sites from A(kkad Survey) No. 064 to 219 refer to ADAMS 1972, 193-204.
4) GIBSON's (1972) sites No. 1 to 24 (including the areas between them) cover about 255 ha. The group of tells constituting site No. 25 (Ishan al-Khazna, Islamic), covers another 8.5 ha.
5) The largest extension in Neo-Babylonian times (outer city-wall including Babil [= Gibson's No. 127]) cover 975 ha, cf. GASCHE and DE MEYER 1986.

Map 9. The river and main canal network of northern Babylonia in the first half of the first millennium BC. Because further investigation is needed, the course of the Tigris is not reconstructed on this map. The sites shown are those surveyed by Adams and/or Gibson, unless otherwise stated. Generated from a combined Microstation and Access database by K. Verhoeven ; © IPA 4/25, Univ. of Ghent.

T. Aswad, **053** = Sites probably founded during Neo-Babylonian times.

064 = Site re-occupied in Neo-Babylonian times after a long gap.

057 = Site occupied more or less continuously before and during Neo-Babylonian times.

Map 10. The river network of northern Babylonia according to *TAVO*, Map B II 12.1 (Mesopotamien in altbabylonischer Zeit: Besiedlung), including sites dated to the Larsa and Old Babylonian periods by ADAMS (1972) and/or GIBSON (1972). Compare Map 8.

Note the way the watercourses are reconstructed. They are represented by lines connecting sites thought to be contemporaneous (concerning the sites dated to the Old Babylonian period by ADAMS [1972], see our n. 2) in disregard of both the relief and the fact that not all contemporaneous sites necessarily have to be situated alongside an old river (see Map 4 for an illustration of the distribution pattern of sites).

Pallukkatu was replaced by the bed of the Euphrates, but it is quite clear that the latter followed the path opened by the former.

According to Arrian, the Pallakottas (= Pallukkatu) was flowing west of Babylon by the time of Alexander.[206] It has even been argued that the large morass near Borsippa attested from the eighth century on was created and sustained by waters from a westerly channel such as the Pallukkatu, and that this channel was being used as an escape for excess Euphrates discharge.[207] By the Seleucid era, the mouth of the Pallukkatu could be closed to raise the level of the river at Babylon,[208] which shows that the Pallukkatu was still a canal.

7. CONCLUSION

We have concentrated on the reconstruction of the river network of northern Babylonia because this region was (and still is) the critical zone of departure for the various Euphrates branches that supplied water to regions further south. Our research program will progressively consider other areas of the floodplain, including the region to the east of the modern bed of the Tigris and that to the south and southeast of ancient Babylon and Kish.

Our approach differs fundamentally from previous attempts to reconstruct the watercourses of Babylonia in the symmetry of its reliance on data drawn from the fields of geomorphology, archaeology, and philology. The results presented herein would have been unachievable by any other method.

We began with the physical remnants of old river branches — that is, their fossil levees (and fossil meanders) — which, because of their relief, can be mapped. Such levees, once they attained a certain height, from then on became the basic conduits of irrigation on the Babylonian plain, and the system of levees became its permanent infrastructure. Even when the natural watercourses left their channels, the levees remained and could be used as platforms for secondary canals. Other physical evidence — specifically that resulting from dike-building activities around several large sites — indicates that not only were there rivers or river branches near these sites, but also that there were seasonal inundations of unusual severity at times, even if some current reconstructions of climatic conditions point to low precipitation and/or relative dry conditions.

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206 *Anabasis Alexandri* VII 21.1-4 (= BRUNT 1983, 277-279). On palaeographic grounds, MEISSNER (1896, 7, n. 3) emended Παλλακόπας in the manuscript tradition of the Arrianus text to Παλλακόττας, which is the correct *lectio* found in Appianus (we thank L. De Meyer for this observation and refinement).

207 COLE 1994.

208 T. Boiy and K. Verhoeven (in this volume), citing evidence from the astronomical diaries.

Once the basic physical network of levees was established, the use of textual information to identify the various ancient river branches was placed on a more secure and objective basis. And although not all the identifications made herein are completely certain, we believe that until additional evidence is uncovered, the overall results of this investigation can serve as a solid, reliable basis for further studies of ancient Babylonian hydrography.

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LE *NAMKARUM*
UNE ETUDE DE CAS DANS LES TEXTES ET SUR LA CARTE

par Michel TANRET *

Dans les pages qui suivent nous proposons une étude du dossier d'un type de cours d'eau attesté dans les textes documentaires paléo-babyloniens : le *namkarum*, traduit par 'irrigation canal' dans les *CAD* et 'Bewässerungskanal' dans le *AHw* [1].

Notre choix s'est porté sur ce cours d'eau parce que nous croyons pouvoir le rattacher à des traces bien visibles et identifiables sur les cartes de détail établies dans le cadre du *Pôle d'Attraction Interuniversitaire IV/25* sur base de la documentation topographique précise, de photos aériennes et d'imagerie satellite [2]. Même sur certaines cartes datant du siècle dernier ces vestiges apparaissent clairement. En d'autres mots, nous tenterons de rapprocher les textes du terrain.

Qu'il soit clair d'emblée que cette entreprise a des limites. Si nous croyons pouvoir apporter des éléments sur la nature, la fonction et la fréquence des *namkarum*s et si nous croyons pouvoir identifier des structures de ce type sur le terrain, nous ne pouvons — pour le moment — établir de lien entre tel *namkarum* dans un texte et telle levée sur le terrain.

Nous présenterons d'abord le dossier en examinant chaque attestation dans son cadre géographique. Les conclusions nous permettront ensuite de passer à la relation avec le terrain.

I. LE MOT ET SON SENS

Le mot *namkarum*, dont l'origine ne remonte pas plus haut que l'époque paléo-babylonienne, est en usage jusqu'au Babylonien tardif.

I.1. La formation

La formation du mot est simple : il s'agit d'une dérivation de la racine *mkr* qui signifie 'inonder, irriguer' à la forme *mapras/napras*.

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* Université de Gand. Nous tenons à remercier L. De Meyer d'avoir bien voulu améliorer ce texte par ses remarques et critiques.

1 Ce dernier dictionnaire donne erronnément m/spB comme périodes d'utilisation de ce mot, à compléter par aB.

2 Cfr la contribution de Cole et Gasche dans le présent volume.

Changing Watercourses in Babylonia.
Towards a Reconstruction of the Ancient
Environment in Lower Mesopotamia I
(= *MHEM* 5/1), Ghent, Chicago, 1998, 65-132.

Comme on pouvait s'y attendre pour un mot introduit si tard, les listes lexicales ne le mentionnent que peu. Deux références, toutes deux nécessairement post-paléo-babyloniennes donnent :

MSL 11, 28	Ḫḫ XXII Section 8 : 8'	pa_5.a.dug_4.ga = *nam-ga-ri*
LTBA 2, 2 : 302		*nam-ga-ru* = *mi-ik-ru*

La première référence décrit le *namkarum* comme un canal (pa_5) caractérisé par ses eaux où le dug_4 est une graphie variante de a.da.ga/a.du_{11}.ga = *šaqû ša eqli* (*CAD* Š II 24 s.v. *šaqû* lex. sect.). Le pa_5.a.dug_4.ga est donc un canal dont la fonction est d'irriguer les champs.

La deuxième référence donne une autre forme de la même racine *mkr* comme équivalent. *Mikru* signifie irrigation ou mise sous eau des champs [3].

I.2. Questions d'orthographe

La découpe en syllabes

Comme il s'agit d'un néologisme, sa tradition orthographique n'est pas encore bien établie et il est écrit de différentes façons. Cette hésitation dans l'orthographe montre qu'il n'y a pas de tradition, que les scribes découpent les syllabes chacun à sa façon :

Etat construit	*Nominatif*	*Génitif*
nam-kar	nam-ka-rum	nam-ka-ri
nam-ka-ar	nam-ka-ru-um	nam-ka-ri-im
	nam-kar-ru-um	
	nam-kar-rum	
	na-am-ka-ru-um	na-am-ka-ri-im

Les formes les plus fréquentes sont l'état construit *nam-kar* (18 x AS-Aṣ) et le nominatif *nam-ka-rum* (13 x Sm-Ae) et 4 génitifs (Sm-Ad).

L'absence de '*nam-ka-rim*' est normale, puisque la valeur '*rim*' est exceptionnelle en paléo-babylonien, elle est toujours rendue par '*ri-im*'.

La découpe du premier ensemble CVC se fait rarement (*MHET* 163, 326, 627, 689) ; ces textes sont tous à dater avant et pendant le règne de Ḫa.

[3] *CAD* s.v. 'irrigation, flooding of fields (an irrigated or irrigable field)', *AHw* : s.v. 'Bewässerung'.

La variante de l'état construit : *nam-ka-ar* est utilisée 6 x (Ḫa-Aṣ). Il s'agit souvent d'autres noms d'*ugārum* que ceux écrits avec *nam-kar*. Dans quelques cas les deux variantes sont employées pour le même *namkarum* :

MHET 189 (Ḫa 16) : *nam-ka-ar a-lim* *CT* 47, 62/62a (Si 9) : *nam-kar* uru^{ki}

Le scribe a clairement utilisé une graphie courte vs. une graphie syllabique/longue mais ce critère ne permet pas de départager toutes les attestations, cfr. p.ex. le '*nam-kar šar-rum* ^{d}utu' (APR 74) où les deux sont mélangées mais où le scribe n'a sans doute pas voulu encore augmenter le nombre de signes.

Il ne semble pas non plus y avoir de raison contraignante pour écrire '*nam-kar-rum ša* a.gàr Tenūnam' (CT 2, 37) ou '*nam-ka-ar* a.gàr Tenūnam' (Di 386), vis à vis de la graphie '*nam-kar* Tenūna' (Di 691) et de '*nam-kar* a.gàr Tenūnam' (Di 680, Di 686, Di 700, *MHET* 332). Il s'agit évidemment de libres choix des scribes. Malheureusement il n'y a pas dans notre documentation de cas où nous pouvons contraster les différents usages par scribe.

I.3. Les scribes

Le scribe le plus fréquent est Ipiq-Aja, ayant écrit cinq de nos textes. Dans l'ordre chronologique :

Di 680	(Si 7)	*nam-kar* a.gàr Tenūnam
JCS 11, 23, 9	(Si 9/7/6)	*na-am-ka-ar* sanga ^{d}utu
CT 47, 62/62a	(Si 9/12/1)	*nam-kar* uru^{ki}
MHET 427	(Si 14)	*nam-kar-rum*
MHET 426	(Si 14)	*nam-kar* Atānum

L'on voit que si d'une part le scribe avait l'habitude d'écrire *nam-kar-*(*rum*) (au lieu de *nam-ka-rum*) il s'est évertué à remplir la cinquième ligne de *JCS* 11, 23 (Si 9). Mais pourquoi ne l'a-t-il alors pas fait dans *CT* 47, 62 (Si 9, tablette et enveloppe) ? Cela nous donne une idée de la marge de liberté des scribes.

Trois textes sont écrits par Uṣur-wedam :

MHET 864	Si 5	*nam-ka-rum*
CT 6, 38a	Si 8	*nam-ka-rum*
MHET 425	Si 13	*nam-ka-ar* Abātim/Atānum

Pas de variantes ici mais une constance dans l'emploi de '*namkarum*' comme indéclinable. Dans les deux premiers textes cités le mot est précédé par '*ita*' et '*ina* gú' respectivement, demandant le génitif.

Šumum-liṣi quant à lui est l'auteur de deux textes (Di 691, Aṣ 4 et *APR* 74, Aṣ 13) où il utilise de façon conséquente '*nam-kar*', tout comme le fait Imgur-Sin (Di 1952, Si 11 et Di 700, Si 21).

I.4. Accord ou pas accord

Le fait aussi que, d'une part, l'état construit est employé ou que *namkarum* est décliné, mais que, d'autre part, il y a des attestations où il est indéclinable, reflète une hésitation. Exceptionnellement, le mot est même précédé par un déterminatif: $^{\text{íd}}$*namkarum* (Di 1458 Si).

Cette variante est visible dans la combinaison *ita/aḫi* + *namkarum* où *namkarum* est invariable ou mis au génitif:

ita nam-ka-rum	Sm	*CT* 47, 18
aḫi nam-ka-ru-um	AS	*CT* 47, 7
ita nam-ka-ru-um	Ḫa 6	*CT* 47, 28/28a
ita nam-ka-rum	Ḫa 17	*MHET* 191
ita nam-ka-rum	Si 5	*MHET* 864
ita $^{\text{íd}}$*nam-ka-rum*	Si [...]	Di 1458
ita nam-ka-rum ša Ibbi-Sin	s.d.	*CT* 45, 113 (= 111)
ita nam-ka-ri-im labīrim	Sm	*CT* 47, 13/13a
ita nam-ka-ri-im eššim	Sm	*ibidem*
ita nam-ka-ri-im	Ad 24	*CT* 45, 50

I.5. Le *namkarum* dans les textes documentaires paléo-babyloniens de Sippar

La documentation paléo-babylonienne de Sippar contient le mot *namkarum*[4] dans 56 localisations de champs. La plupart des ces textes donnent le nom du district d'irrigation (*ugārum*). Nous savons ainsi qu'il y a des *namkarums* dans au moins 17 de ces districts.

Le tableau ci-dessous donne un aperçu des 56 attestations classées par *ugārum*.

I	**Ašukum**		
1	*ita namkarim*	Ad 24	*CT* 45, 50
2	*ita namkar* dumu.meš Awīl-Šamaš	Aṣ 11/8/4	*CT* 6, 6
II	**Atanānum**		
3	*ita namkar* Abātim	Si 13/9/10	*MHET* 425
4	sag.bi *namkar* (Ḫ)atānum	*ibidem*	

[4] Afin d'éviter toute confusion de traduction, nous utiliserons toujours le mot accadien *namkarum* (au pluriel *namkarums*). Bien qu'en règle générale dans les traductions de textes nous sommes persuadé que c'est une pratique à éviter, dans le cas présent l'emploi de 'canal d'irrigation' nous semble être pléonastique et source possible de confusion.

III	**(ša) Bīnum**		
5	sag.1 *namkarum*	Sm	*MHET* 99
6	sag.2 *namkar* Abātum	s.d.	*MHET* 604
IV	**Eble**		
7	*aḫi namkarum*	AS	*CT* 47, 7/7a
8	2 sag.bi *namkarum*	AS 13/2/xx	*CT* 6, 46
9	sag.1 *namkar* ⸢x⸣-x-x-a	Si xx	*MHET* 606
V	**Gamānanum**		
10	sag.2 *namkarum*	s.d.	*CT* 47, 78/78a
VI	**uru Gula**		
11	*namkar* aga.uš.meš	Aṣ 16/5/[ ]	*MHET* 549 = *CT* 2, 8
12	*idem*	*idem*	*CT* 2, 8
VII	**Ḫalḫalla**		
13	*ita namkar* uru^{ki}	Si 9/12/1	*CT* 47, 62/62a
14	*ita namkar* [...]	Si 15/1/[ ]	*MHET* 430
15	sag.1 *namka*[...]	s.d. (Sm-Ḫa)	*MHET* 627
	'dossier Ḫalḫalla'		
16	sag.1 *namkar* Atānum (ú.sal Euphrate)	Si 14	*MHET* 426
17	*ita namkarum*	Sm	*CT* 47, 18
18	*ita namkarim*	Ḫa 11	*MHET* 163
19	*ina* gú *namkarum*	Si 8	*CT* 6, 33A
20	*namkarum*	[AS?]	*MHET* 729
21	sag.2 *namka*[...]	Ḫa xx	*MHET* 326
22	*ita namkarim labīrim* (envelope : *šaplim*)	Sm	*CT* 47, 13/13a
23	*ita namkarim eššim*		*ibidem*
24	sag.1 *namkarum*	Sm 5?/6/-	*CT* 47, 9
25	*ita namkarum*	Ḫa 6	*CT* 47, 28/28a
26	sag.bi *šaplītum namkar ālim*	Ḫa 16	*MHET* 189
27	*nam-kar*[...] ??	Ḫa 14	*MHET* 172
VIII	**Ḫarbanî**		
28	*ita namkar* Abu-Ṭābum	Aṣ 12/4/26	*MHET* 901
IX	**Ḫaṣārum**		
29	*ita* e *namkar* a.gàr	Aṣ 6/1/26	*MHET* 509
X	**Iṣṣiātum**		
30	*ita namkarum*	Si 5/10/20	*MHET* 864
31	*ita namkar* sanga Šamaš	Si 9/7/6	*JCS* 11, 23, 9
31a	*ina namkarīša*	Si 9/7/26	*CT* 2, 5

32	sag.2 e *namka<rum> ša* dumu.meš Sin-iddinam	Ae [ ]	*MHET* 477
XI	**Iškun-Ištar**		
33	sag.2 *namkar* Ilšu-bāni	Si 11/12/1	Di 1952
XII	**Lugal-sagila**		
34	*ita namkarum ša* I[bbi-Sin] [5]	Ḫa 17	*MHET* 191
35	*ita namkarum ša* Ibbi-Sin	s.d.	*CT* 45, 111 [6]
36	*ita namkarum ša* Ibbi-Sin	s.d.	*CT* 45, 113
37	*ita namkar ša* Ibbi-Sin	s.d. (post Ḫa 17)	*MHET* 584
XIII	**Maḫana**		
38	sag.2 *namkar*	s.d.	*MHET* 683
XIV	**Tawirātum**		
39	sag.1 *namkarum*	Si 14/5/3+	*MHET* 427
XV	**Tenūnam**		
40	sag.2 *namkarum ša* agar Tenūnam	Za	*CT* 2, 37
41	sag.1 *namkar* agar Tenūnam	Si 7/12/20	Di 680
42	*namkar* agar Tenūnam	Si 21/10/15	Di 700
43	sag.2 e *namkar* agar Tenūnam	Aṣ 4	Di 686
44	sag.2 *namkar* Tenūnam	Aṣ 4	Di 691
45	e *namkar* agar Tenūnam	s.d.	Di 386
46	sag.1 *namkar* agar Tenūnam (2x)	Ḫa [ ]/4/18-19	*MHET* 332
XVI	**Ṭābum**		
47	*ita namkarim*	Ae "k"	*MHET* 675
48	*namkar* Šarrum-Šamaš	Aṣ 13/1/3	*APR* 74
XVII	**0.1.3 iku**		
49	*namkarum*	AS 1	*CT* 4, 10
50	*namkar* Iliš-ti[kal?]	Aṣ 11/1/22	*BBVOT* 1, 114
XVIII	**(sans nom)**		
51	*ita* ^íd^*namkarum*	Si [...]	Di 1458
52	*ina namkarum*	Ḫa 22	*VS* 9, 19/20
53	sag.1 *namkar* agar	Si 2	Di 1131
54	*adi namkari*	Ae xx	*TLB* I, 225
55	*ita namkarim*	date cassée	*MHET* 689
56	sag.1 *namkarum* gal *ša ita* ^giš^tir	s.d. (post Ḫa 17)	*MHET* 584

[5] Tablette : *namkarum* tout court ; enveloppe *namkarum ša* I-⌈bi⌉-[...].

[6] *MHET* 584, *CT* 45, 111 et 113 (post Ḫa 17) sont des copies du même document : une liste d'achats de champs par la famille Akšaja. Tous les champs sont situés dans les environs de l'Irnina, de la grande digue (e gu-la) et des *tawirtum*s de Lugalsagila et de *Ibbi-Sin*.

Comme on l'aura remarqué, dans quelques cas il ne s'agit pas du *namkarum* même mais de sa digue 'e *namkarum*' : Ḫaṣārum, Iṣṣiātum et Tenūnam ; ou de son bord 'gú *namkarim*'.

II. LA LOCALISATION DES *UGĀRUMS*

Puisque bon nombre de *namkarums* sont localisés dans des *ugārums*, il nous a semblé utile de rassembler des éléments permettant de localiser relativement ces *ugārums* et donc aussi ces *namkarums*.

Grâce au corpus de textes immobiliers paléo-babyloniens des deux Sippar, considérablement augmenté par les volumes *MHET* de L. Dekiere, grâce aussi aux nouvelles données contenues dans les archives d'Ur-Utu et de son père, nous disposons d'éléments que nous pouvons tenter de combiner avec les tracés de l'Euphrate et de l'Irnina établis par St. Cole et H. Gasche dans leur contribution au présent volume.

Selon la proposition de ces auteurs, en schématisant les données, le cours de l'Irnina est parallèle avec et au nord de l'Euphrate. Tous deux coulent d'ouest en est. Les eaux de l'Irnina proviennent de l'Euphrate et se déversent dans le Tigre. L'ensemble constitue un très schématique rectangle fermé dont le côté gauche est constitué par l'Euphrate dans son cours nord-sud, le droit par le Tigre, le supérieur par l' Irnina et l'inférieur par l'Euphrate.

Près de l'Euphrate, au sud de celui-ci, il y a Sippar-Jaḫrūrum (Abū Ḫabbah) et au nord Sippar-Amnānum (Tell ed-Dēr). Cette dernière localité se situe donc dans le territoire entre l'Euphrate et l'Irnina.

Ce schéma général nous permettra de situer globalement un certain nombre d'*ugārums*. Notre point de départ sera formé par les textes *MHET* 870 (Si 16) et 894 (Ad 34) qui donnent des listes d'*ugārums* en précisant qu'ils appartiennent au territoire de Sippar-Amnānum (*ina erṣet Sippar-Amnānum*). Dans le cas de *MHET* 870 il est spécifié en plus qu'il s'agit de champs de l'autre côté de l'Irnina (bal.ri Irnina). Il va de soi que ces listes sont loin d'être exhaustives, le but de ces textes n'étant pas de donner une description cadastrale mais d'énumérer des champs distribués (*ṣibtū*) à des militaires de Sippar. Voici les données qui nous intéressent :

MHET 894			*MHET* 870
ina erṣet S-A	Paḫuṣum	Ṭābu	*ina erṣet S-A bal.ri Irnina*
Baṣi	Našurēš	Amurrum	Nagûm
Buša	Lašala	Dirītum	Še.gi$_6$
Bura	Zubanu	Ḫagiānum	Merigat
9 gán	Ša Gula	Ašukum	Kabīrum

Le fait qu'il s'agit de deux listes d'*ugārums* différents montre bien que l'addition 'bal.ri Irnina' dans *MHET* 870 est significative.

II.1. Trois régions deux *erṣētu*

Comme Sippar-Amnānum et Sippar-Jaḫrūrum se situent de deux côtés de l'Euphrate, la première au nord et la seconde au sud, nous proposons de comprendre par territoire (*erṣetum*) de Sippar-Amnānum la région au nord de l'Euphrate (dans son cours ouest-est). La région au sud serait alors le territoire (*erṣetum*) de Sippar-Jaḫrūrum.

Sippar-Amnānum s'étendrait même encore plus loin, au-delà, au nord de l'Irnina, région appelée '*erṣet Sippar-Amnānum* bal.ri Irnina'.

II.2. Un ordre de grandeur ?

Nous avons donc, dans *MHET* 894 une liste d'*ugārums* qui se situent dans le territoire de Sippar-Amnānum, entre l'Euphrate et l'Irnina selon notre hypothèse. *MHET* 870 quant à lui, donne quatre *ugārums*, également dans le même territoire mais au-delà de l'Irnina.

Les surfaces énumérées dans ces deux textes ne nous donnent malheureusement qu'une approximation minimale de l'étendue de ces *ugārums*. N'y sont indiquées que les surfaces des champs destinés aux militaires.

Pour Nagûm le texte est endommagé, ce qui reste donne déjà un total de 4.2.5 (= 32,04 ha). Le total pour Še.gi$_6$ est conservé : 3.2.2 1/2 iku (= 24,66 ha). Dans Merigat il y a 2.2.1 iku (= 17,64 ha). Dans Kabīrum il y a un seul grand champ d'attribué : 1.0.0 iku (= 6,48 ha).

MHET 894 donne un grand total pour les *ugārums* cités de 34.1.1 iku 10 sar. Si nous en soustrayons les surfaces situées dans les territoires des trois autres villes (Kullizu, Saddi et Ṣ/Zarbatum), 0.2.4 iku + 2.2.0 iku 30 sar + 1.0.4 iku = 4.2.2 iku 30 sar, cela donne 29.1.4 iku 80 sar, soit 191,8 hectares de terres réservées aux militaires dans 14 *ugārums* entre l'Euphrate et l'Irnina.

Une très approximative estimation de la surface totale entre l'Irnina et l'Euphrate nous donne un ordre de grandeur de 13.500 ha [7]. Rien ne permet, bien entendu, d'affirmer que cette surface entière était cultivable ou cultivée.

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[7] Nous remercions K. Verhoeven qui a exécuté ce calcul sur base du GIS.

II.3. Comme une rivière de diamants

Partant de ces premières listes nous pouvons tenter de localiser les autres *ugārums* dans lesquels un *namkarum* est attesté [8].

Un principe qui nous guidera dans cette recherche est que si un cours d'eau est attesté dans une des trois régions définies ci-dessus : au nord de l'Irnina, entre l'Irnina et l'Euphrate ou au sud de l'Euphrate, tout son cours sera nécessairement confiné à cette même région puisqu'il ne peut évidemment traverser ni l'Euphrate ni l'Irnina.

Conséquence logique et intéressante pour nous : tous les *ugārums* traversés par un cours d'eau se situent dans la même région que lui. Les *ugārums* sont comme les diamants qui s'enfilent l'un après l'autre sur la rivière.

Le íd *Zabium*

Notre première liste d'*ugārums* (*MHET* 894) nous donne e.a. Ašukum et Paḫuṣum entre l'Euphrate et le Tigre. La voie d'eau commune à ces deux *ugārums* est le íd Zabium (e.a. *CT* 47, 63 Si 14 et *BE* 6/1, 83 Ad 31).

Cette rivière traverse également les *ugārums* Ušgida, Iškun-Ištar, Iṣṣiātum (*CT* 2, 5 Si 9) et l'illisible KU ḪU X AN. Elle trouve son origine dans l'Irnina (*MHET* 608 sans nom d'*ugārum*) [9].

Le íd Lugal/*Šarrum*

Cette rivière apparaît dans Ašukum [10] (*YOS* 13, 470 s.d.) ce qui la situe entre l'Euphrate et l'Irnina.

Elle est mentionnée également dans Bāb ālim (*MHET* 108 et 217) et Iṣṣiātum (Di 705 et Di 681/691b), 0.1.3 iku (*MHET* 168) et Ḫalḫalla (*MHET* 615) ce qui nous permet de localiser ces *ugārums* dans cette même région.

Puisqu'un champ de l'*ugārum* Gaminānum est dit '*ina* a.gàr Gaminānim *ša* Ḫalḫalla^{ki}' (*MHET* 417 Si 10), et en supposant que Ḫalḫalla se situe tout entier d'un côté de l'Euphrate et de l'Irnina, Gaminānum se trouve aussi entre ces deux cours d'eau.

Exactement le même raisonnement peut être développé pour Eble avec *MHET* 606 (date perdue *ca* Si) : '0.0.4 iku a.šà kankal a.gàr 0.1.0 iku.ta *ina* Ḫalḫalla^{ki}'.

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8 Notre étude globale et exhaustive sur la localisation de tous les *ugārums* sippariotes ainsi que des cours d'eau et de leurs digues sera publiée prochainement.

9 Nous démontrerons dans nos 'Chains of Transmission' que Paḫuṣum, Ušgida et Iškun-Ištar sont limitrophes.

10 Sous forme de sa digue : e *šarri*. La digue se situe à côté de la rivière comme le montre *MHET* 108 et 217 : e ^{íd}*šarrim*.

Le ^íd^*Nabium-ḫegal*

Le ^íd^Nabium-ḫegal passe par Tenūnam, Gizānum et Nagûm. Comme nous savons que Nagûm se situe bal.ri Irnina (e.a. *MHET* 552, Aṣ 17), au nord de celui-ci, les deux autres *ugārums* traversés par le même cours d'eau doivent aussi s'y situer.

L'*ugārum* Ḫaṣārum se trouve bal.ri íd (*BE* 6/1, 94, Aṣ 3) [11]. Nous interprétons cette expression, utilisée sans nom de cours d'eau, comme se référant généralement à l'Irnina. En effet, quatre *ugārums* sont décrits comme bal.ri íd sans plus.

Il s'agit de : Tenūnam,
Kabīrum [qu'un autre texte situe bal.ri Irnina (*MHET* 224, Ḫa 26)],
Merigat [situé bal.ri Irnina par *MHET* 870],
Ḫaṣārum.

Comme les trois premiers sont certainement bal.ri Irnina ce doit être le cas pour Ḫaṣārum aussi.

Le ^íd^*Gunâ*

Ce cours d'eau nous permettra d'avancer une localisation encore incertaine pour l'*ugārum* par lequel il passe : Maḫana (*MHET* 683 s.d.).

Dans *MHET* 555 (Aṣ 18) un champ est délimité par un ^íd^gu[...] d'une part et l'a.gàr bu[...] de l'autre. Il n'y a que deux *ugārums* dont le nom commence par bu- : Buša et Burâ, tous deux situés entre l'Euphrate et l'Irnina (*MHET* 894). Si le ^íd^gu[...] est le ^íd^Gunâ, celui-ci doit se situer dans la même région, ainsi que l'*ugārum* Maḫana.

Les incertains

Quelques-uns de nos *ugārums* ne peuvent pas (encore) être situés avec certitude.

(ša) Bīnum

La difficulté de localisation repose sans doute sur le fait que dans certains textes *bīnum* peut signifier 'tamaris' sans plus tandis que dans d'autres c'est un nom d'*ugārum*.

C'est ainsi qu'un champ dans l'*ugārum* Nagûm de l'autre côté de l'Irnina se trouve entre le ^íd^Nabium-ḫegal et '*bīnum*' (Di 1952). S'il s'agit de l'*ugārum* Bīnum, celui-ci se trouve donc certainement au nord de l'Irnina.

D'autre part le ^íd^Akšak-gamil passe par 'ša Bīnê' (*MHET* 81/82, *CT* 47, 49). Or, cette rivière passe par Qablûm (*MHET* 189) ce qui situe le tout entre l'Euphrate et l'Irnina.

Malheureusement les références mentionnant explicitement a.gàr (*MHET* 604) ne contiennent pas d'informations concernant la situation de Bīnum. Ša Bīnum est

[11] Le texte donne : 'šà nagûm bal.ri íd. Puisque nous croyons qu'un *ugārum* ne peut se trouver dans un autre, nous interprétons 'šà nagûm' comme 'faisant partie de la dépression'. Il est bien entendu possible que l'*ugārum* Nagûm tire son nom de son association avec une/cette dépression.

délimité par le *namkar* Abātum (*MHET* 604) qui est en relation avec le *namkar* Atānum (*MHET* 425, Si 13) qui provient de l'Euphrate (*MHET* 426, Si 14).

Atanānum

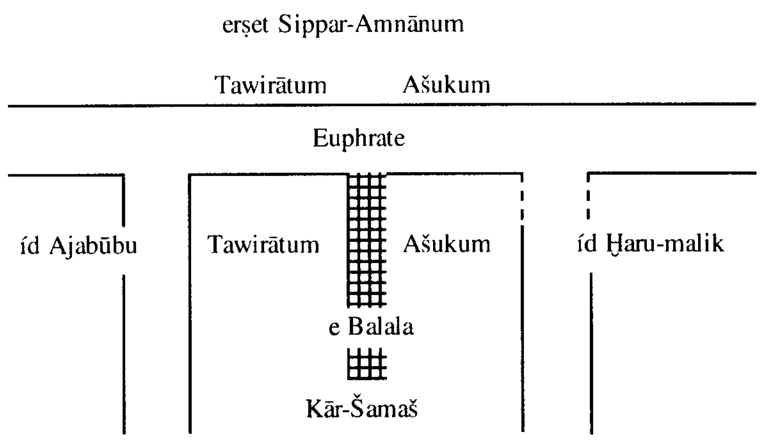
Selon *MHET* 425 (Si 13) cet *ugārum* comportait un champ délimité par deux *namkarums*: Abātum et Atanānum. Le *namkar* Abātim délimite aussi un champ de l'*ugārum* Bīnum (*MHET* 604 s.d.). Comme nous n'avons pas d'autres éléments, la localisation de Atanānum doit donc reposer sur celle de Bīnum, et reste donc, comme celle-ci, incertaine.

Ḫarbāni

Selon *MHET* 901 cet *ugārum* contient des champs délimités par l'Euphrate, mais se situe-t-il au nord ou au sud de ce fleuve ? Impossible pour le moment de le déterminer.

Tawirātum, Kār-Šamaš et Ašukum

Selon *CT* 6, 6 Ašukum se trouve dans le territoire de Sippar-Jaḫrūrum, contrairement à notre liste *MHET* 894 qui le place dans celui de Sippar-Amnānum.
En fait il n'y a pas de contradiction mais nous devons conclure que Ašukum s'étendait des deux côtés de l'Euphrate. Un champ dans cet *ugārum* est délimité par la digue de Balala. Comme il s'agit du côté Jaḫrūrum, cela se situe donc au sud de l'Euphrate. Cette même digue forme la limite d'un champ dans Tawirātum.
Les deux *ugārums* sont de fait séparés par cette digue, ce qui montre que Tawirātum est également au sud du fleuve.
A cela il faut ajouter que la présence du ídAkšak-gāmil dans Tawirātum montre que, tout comme son voisin Ašukum il s'étendait aussi au nord.
Tous deux sont dits dans leur partie sud 'ina Kār-Šamaš' cette localité se situait donc au sud de l'Euphrate.



II.4. Les *ugārums* localisés

En résumé nous avons donc dégagé les localisations suivantes des *ugārums* de nos *namkarums* :

1. Au nord de l'Irnina :	Gizānum	Še.gi$_6$/Šemum ṣalmum
	Kabīrum	Tenūnam
	Merigat	Ḫaṣārum
	Nagûm	et le ídNabium-ḫegal
2. Entre l'Irnina et l'Euphrate :	Amurrum	Iškun-Ištar
	Ašukum 1	KU ḪŪ X AN
	Bāb alim	Lašala
	Baṣi	Maḫana ?
	Buša	Našurēš/Lugalsagila
	Burâ	Paḫuṣum
	Dirītum	Ša Gula
	Eble	Tawirātum 1
	Gami/anānum	Ṭābu
	Ḫagiānum	Ušgida
	Ḫalḫalla	Zubānu
	Iṣṣiātum	9 gán
	et les rivières íd Zabium, íd Lugal/Šarrum et íd Akšak-gamil	
3. Au sud de l'Euphrate :	Tawirātum 2	Ašukum 2
	et les rivières ídAjabūbu et ídḪaru-malik	
4. Localisation incertaine :	ša Bīnum	Atanānum
	Ḫarbāni	

III. DISCUSSION DES RÉFÉRENCES

Nous dégagerons d'abord les éléments intéressants pour notre étude, texte par texte, par *ugārum*.

I. Ašukum

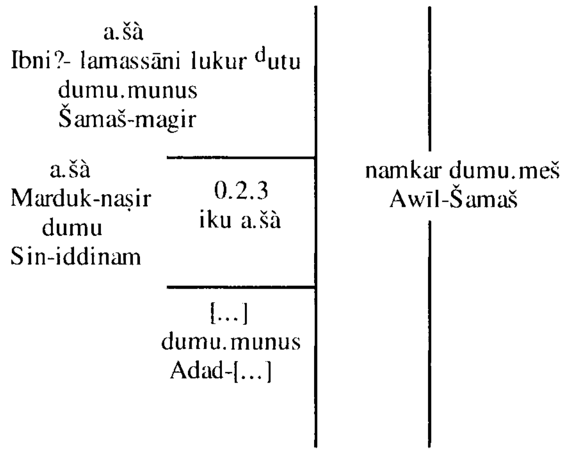
I.1. *CT* 45, 50 Ad 24/2/10 bail à ferme ; Aja-rišāt fille d'Ilšu-ibnīšu baille à Ibni-Marduk, *bāru*.

1. 0.2.4 iku a.šà a.gàr *a-šu-*⸢*ku*⸣
2. *i-ta nam-ka-ri-im*
3. *ù i-ta* a.šà *be-le-sú-nu* lukur dutu dumu.munus *gi-mil-*dAMAR.UTU

Il s'agit d'un champ de 0.2.4 iku (576 ares) situé dans l'*ugārum* Ašukum, entre le *namkarum* et un champ de Bēlessunu, prêtresse nadītum de Šamaš, fille de Gimil-Marduk.

I.2. *CT* 6, 6 Aṣ 11/8/4 certificat d'une chaîne de transmission.

1. *aš-šum* 0.2.3 iku a.šà a.gàr *a-šu-kum*
2. *i-na* bal.ri ⸢*kar*⸣-^{d}utu^{ki} šà! *er-ṣe-*⸢*et*⸣ ud.kib.nun^{ki}-*ia-aḫ-ru-rum*
3. *i-ta nam-kar* dumu.meš *a-wi-il-*^{d}utu
4. *ù i-ta* a.šà ^{d}AMAR.UTU-*na-ṣi-ir* dumu ^{d}EN.ZU-*i-din-nam*
5. *ša e-ri-iš-ti-*^{d}*a-a* lukur ^{d}utu dumu.munus *i-bi-*^{d}gìr *ša-ma-at*
6. sag.bi.1.kam.ma a.šà *ib-ni* [?]*la-ma-sà-ni* lukur ^{d}utu
7. dumu.munus ^{d}utu-*ma-gir* ⸢x⸣ [...] um/dub? ⸢x⸣ [...] ⸢x⸣ ...
8. sag.bi.2.kam.ma [...] ⸢dumu.munus⸣ ^{d}iškur [...] ⸢x⸣



La propriété concernée est un champ de 0.2.3 iku (540 a) dans Ašukum, de l'autre côté de Kār-Šamaš, dans le territoire de Sippar-Jaḫrūrum. Elle jouxte trois champs et le *namkarum* 'des fils/descendants d'Awīl-Šamaš'.

Awīl-Šamaš ni ses fils ne sont mentionnés ailleurs dans le texte, le nom du *namkarum* doit donc référer ou bien à une situation antérieure ou a des propriétés situées ailleurs le long de son cours. En fait, un texte daté de Si 19/5/14 (Di 2115) mentionne e.a. un champ de 3 iku (108 ares) dans Ašukum, jouxtant deux autres champs (dont un appartenant à un sanga de Šamaš), un *atappum* ('*atap* Iddin-Bunene') et un *balīṭum*.

Le champ fait partie des propriétés de Apil-ilīšu, dont un des fils s'appelle Awīl-Šamaš. Il n'y a nulle preuve que celui-ci soit le même que le père mentionné dans *CT* 6, 6, ce n'est qu'une simple possibilité mais les dates des deux textes ne s'y opposent pas.

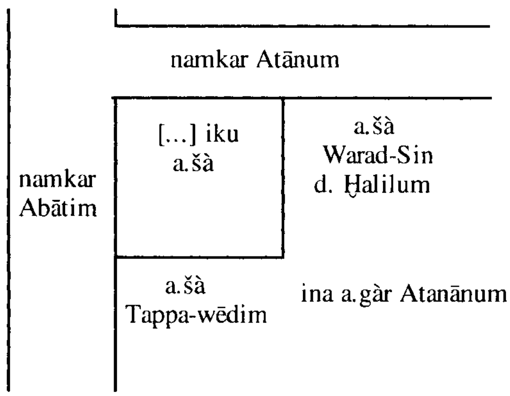
Remarquons que le nom du *namkarum* rappelle la façon qu'avaient les scribes paléo-babyloniens de mettre à jour les noms des propriétaires des champs. Lorsqu'ils devaient indiquer les voisins d'un champ vendu ils avaient le choix entre le nom des propriétaires d'origine, même s'il y avait plus d'un siècle que la propriété était dans leur famille, ou bien ils faisaient précéder ce nom de 'dumu.meš', descendants de, pour marquer que la propriété avait été transmise dans la famille par héritage, sans documentation écrite.

Le nom d'un *namkarum* pouvait donc aussi être mis à jour de la même façon.

II. Atanānum

II.3-4.	*MHET* 425	Si 13/9/10	vente d'un champ de Šeriqti-Aja, lukur ^{d}utu, fille de Šamaš-rē'um, à Bēlessunu, lukur ^{d}utu, fille d'Ikūn-pī-Sin.

1. [...] iku a.šà *i-na* a.gàr *a-ta-*⸢*na*⸣*-nu-um*
2. *i-ta* a.šà ìr-^{d}EN.ZU dumu *ḫa-li-lum*
3. *ù i-ta nam-ka-ar a-ba-tim*
4. sag.bi *nam-ka-ar a-tá-nu-um*
5. sag.bi.2.kam.ma a.šà tab.ba-*we-di-im*



Un champ dont la superficie n'est pas conservée, dans l'*ugārum* Atanānum, est situé entre un autre champ et le *namkarum* Abātum. Par devant il jouxte le *namkar* Atānum, par derrière un troisième champ.

Nous avons donc ici le cas de deux *namkarum*s qui se rejoignent, ou partent d'une même origine. Un des deux porte un nom très similaire à celui de l'*ugārum* qu'il irrigue : a-tá-nu-um/a-ta-na-nu-um. Tous deux sont attestés comme noms de personnes.

III. ša Bīnum

III.5. *MHET* 99 Sm donation ou héritage ; donateur et récipiendaire sont cassés.

1. ⌜0.0.3 iku a.šà⌝ a.<gàr> *ša bi-nu-um*
2. *i-ta* a.šà ^{I}⌜*ip*⌝-*qú-ša*
3. *ù i-ta a.*⌜šà⌝ ^{I}*ma-nu-um-ba-lum*-dingir
4. sag.1.kam *nam-ka-rum*
5. sag.2.kam ^{I}*ṣi-ri-ḫa-tum*

Il s'agit e.a. d'un champ de 3 iku (108 ares) situé entre trois autres champs. Par devant il longe le *namkarum* (cfr le texte suivant).

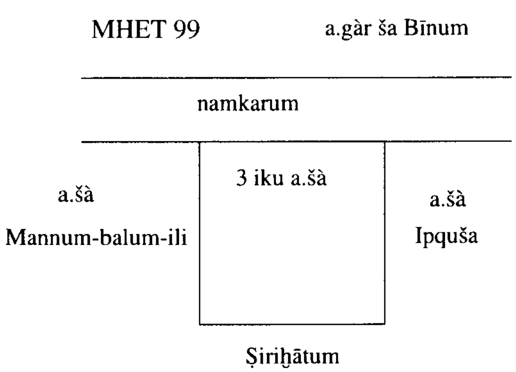
III.6. *MHET* 604 s.d. donation de Awīl-ili à sa fille Amat-Šamaš, ses frères seront ses héritiers.

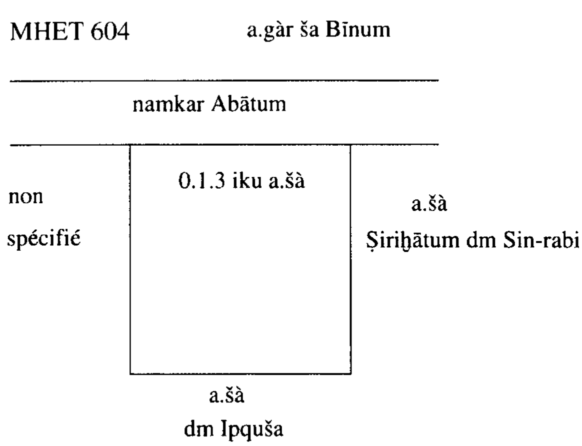
1. 0.1.3 iku a.šà a.gàr a.šà *bi-nu-um*
2. *i-ta* a.šà *ṣi-ri-ḫa-tum*
3. dumu.munus ^{d}EN.ZU-*ra-bi*
4. sag.bi.1.kam a.šà dumu.me *ip-qú-ša*
5. ⌜sag⌝.bi.2.kam *nam-ka-ar* ⌜*a*⌝-*ba-tum*

Un champ de 0.1.3 iku (324 ares) est donné par un père à sa fille, ses frères seront ses héritiers.

Trois voisins seulement sont donnés, deux champs et le *namkarum* Abātum. C'est probablement du même champ qu'il est question dans le sommaire *MHET* 63 (s.d.).

Les propriétaires des deux champs avoisinants sont à mettre en relation avec ceux cités dans *MHET* 99.



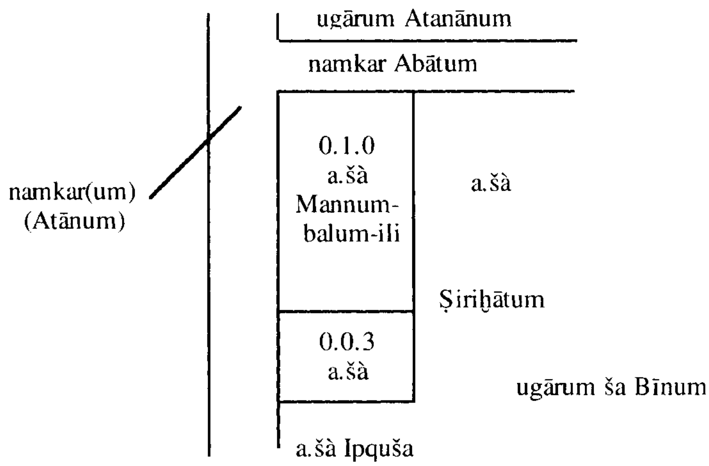


Il est possible de coordonner ces deux textes.

Nous savons que les *namkarums* Atānum et Abātum se rejoignent (*MHET* 425, notre II 3-4).

Si nous tournons notre croquis de *MHET* 99 un quart de tour à gauche et inversons les voisins de gauche et droite, il apparaît que le champ de Mannum-bālum-ili devait mesurer 1 eše et se situer à l'endroit où les deux *namkarums* se rejoignaient. Cela correspond aussi bien avec la disposition des côtés 'sag' des deux champs. Comme dans la plupart des cas ces deux champs ont leur côté étroit (sag) le long du cours d'eau.

Entre *MHET* 99 et 425 Awīl-ili aurait acquis ou hérité de ces deux champs [12]. Cela impliquerait que le *namkarum* sans nom de *MHET* 99 était le *namkarum* Atānum.



Dans *MHET* 425 (cfr *supra*) un champ dans l'angle du *namkarum* Atānum et du *namkarum* Abātum était dans l'*ugārum* Atānum. Notre champ de 0.1.3 occupe également un angle formé par les mêmes *namkarums* mais il est situé dans l'*ugārum* ša Bīnum. Il s'agit donc de deux angles différents. Les *ugārums* Atānum et ša Bīnum sont donc limitrophes, séparés seulement par un *namkarum*.

Il reste cependant un problème. Dans *MHET* 604 un des voisins '*ita*' n'est pas donné. Selon notre reconstruction il s'agirait du *namkarum* Atānum. Est-il possible que dans la description du champ on omette un *namkarum* voisin ?

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[12] Bien que *MHET* 604 ne soit pas daté il est possible de déterminer qu'il est postérieur à *MHET* 99 (Sm) par le fait que le premier désigne un voisin comme 'dumu.me Ipquša', les enfants/descendants d'Ipquša, alors que le second texte donne encore Ipquša lui-même comme voisin.

IV. Eble

IV.7. *CT* 47, 7/7a AS adoption avec héritage. Bēlessunu, prêtresse nadītum de Šamaš, fille de Maḫšanu adopte Erištum nadītum également, fille de Sin-ilum.

5. 0.1.3 iku a.šà *i-na e-eb-le-e*
6. *a-ḫi nam-ka-ru-um*
7. *i-ta* ^{d}EN.ZU-*i-din-nam*
8. *ù ḫa-ia-um*
9. *ù na-bi-*^{d}EN.ZU

Une prêtresse *nadītu* en adopte une autre et lui donne 0.1.3 iku (324 ares) de champ dans Eble, à côté (*aḫi*) du *namkarum*. Cette précision n'est peut-être pas indiquée sur l'enveloppe.

La présence dans la liste des témoins, des sanga de Šamaš et d'autres membres du personnel du même temple dénote l'assise sippariote des personnes concernées. Le sanga d'Ikūnum renvoie à la localisation des biens concernés dans le domaine de Ḫalḫalla (STOL 1998, 437).

IV.8. *CT* 6, 46 AS 13/2/- vente de champ de Šamaš-īn-mātim fils de Puzur-Šamaš à Lamassi, nadītum de Šamaš, fille de Nākarum.

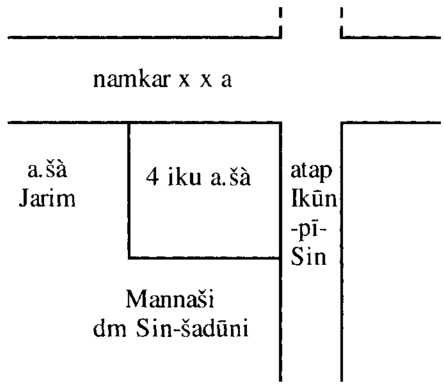
1. dub 0.1.0 iku a.šà *i-na eb-le-e*
2. *i-ta be-le-sú-nu* dumu.munus dumu *sa-qa-aḫ-ta-nu-ú*
3. *ù i-ta* é.a an.dul$_7$.lí
4. dumu ⸢x⸣ [ ] ⸢x⸣-*tim*
5. 1 sag.bi *sú-mu-ia* dumu *ḫa-ú-um*
6. 1 sag.bi *nam-ka-rum*

Un champ de 1 eše (216 ares) est vendu. Il est situé entre trois autres propriétaires et le *namkarum*.

IV.9. *MHET* 606 date cassée, probablement Si : vente de champ ; Mannaši, fille de Sin-šadūni, vend 4 iku (144 ares) de son champ à Bēlessunu, nadītum de Šamaš, fille d'Ikūn-pī-Sin.

1. 0.0.4 iku a.šà kankal a.gàr 0.1.0 iku.ta.⸢a⸣
2. *i-na* ḫal-ḫal-la^{ki}
3. *i-ta* a.šà *ia-ri-im*
4. *ù i-ta a-tap i-ku-un-pi*$_4$-^{d}EN.ZU
5. sag.bi.1.kam *nam-kar* ⸢x⸣-x-a
6. sag.bi.2.kam *ma-an-na-ši*
7. dumu.munus ^{d}EN.ZU-*ša-du-ni*

Ce que nous pouvons représenter par :



La formulation dans la première ligne du texte est intéressante puisqu'elle montre que l'*ugārum* Eble se situe dans le territoire de Ḫalḫalla.

Nous voyons donc qu'un *atappum* est dérivé du *namkarum*. Nous ne savons pas s'il y avait un *atappum* de l'autre côté du *namkarum*.

Remarquons, en passant, que l'acheteur est Bēlessunu, prêtresse nadītum, fille d'Ikūn-pī-Sin d'après qui l'*atappum* est nommé. L'identité du patronyme avec le nom de l'*atappum* n'est sans doute pas le fait du hasard.

Ce texte peut être raccordé à quelques autres également situés à Ḫalḫalla et que nous traiterons sous ce vocable.

Dans cet *ugārum* deux fois le *namkarum* apparaît sans nom, une fois il est nommé. Cette variation semble indiquer que toute confusion entre *namkarum*s était exclue, en d'autres mots, qu'il n'y en avait qu'un seul.

V. Gamānanum

V.10. *CT* 47, 78/78a s.d. don de Nabi-Šamaš à sa fille Rubātum, nadītum de Šamaš, l'héritier de cette dernière est Šamaš-šeme.

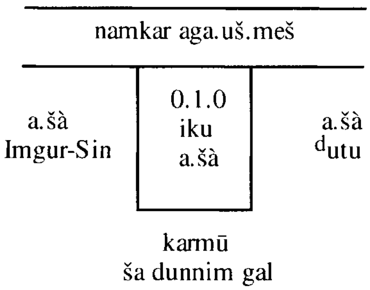
1. 0.0.3 iku a.šà *i-na ga-ma-a-na-nim*
2. *i-ta* ^{d}EN.ZU-*re-me-ni*
3. *ù i-ta na-bi-*^{d}utu
4. sag.1.kam sin-*i-din-nam* dumu ka da da
5. sag.2.kam *nam-ka-rum*

Le père donne e.a. 3 iku (108 ares) dans Gamanānum. Le champ se trouve entre trois autres et le *namkarum* (sans nom).

VI. (Uru ^{d}) Gula

VI.11-12 *MHET* 549 Aṣ 16/5/[ ] = *CT* 2, 8 Aṣ 16/5/20 bail à ferme de Tarībatum, nadītum de Šamaš, fille de Warad-Sin, à Labištum, fils de Sin-rēmēni.

1. 0.0.4 iku a.šà ab.sín
2. 0.0.2 iku a.šà kankal
3. 0.1.0 iku a.šà a.gàr uru ^{d}⌈gu⌉.[la]
4. *i-ta* a.šà ^{d}utu
5. *ù* ⌈*i*⌉*-ta* a.šà *im-gur-*^{d}EN.ZU
6. sag.bi.1.kam *nam-kar* aga.uš.meš
7. sag.bi.2.kam *ka-ar-mu*
8. *ša du-un-nim* gal



Excepté quelques variantes minimes, *MHET* 549 et *CT* 2, 8 sont identiques. Il s'agit selon toute probabilité des exemplaires pour les deux partis.

Un champ de 1 eše (216 ares), partagé en 1/3 de terrain en friche et en 2/3 de terrain cultivé est donné en location. Le champ est situé dans l'*ugārum* de la localité Gula. Il se situe entre le champ du dieu Šamaš et un autre. Par devant il est limité par le *namkarum* des soldats (*namkar* aga.uš.meš), derrière il y a les ruines des grandes fortifications (*karmū ša dunnim* gal).

Dans Di 312 (Aṣ 16) nous trouvons 'a.gàr gu.la aga.uš' dans la description d'un champ jouxtant l'Euphrate. La qualification 'aga.uš' ajoutée au nom de l'*ugārum* doit signifier qu'une partie au moins était réservée aux soldats, ce qui explique le nom du *namkarum*.

VII. Ḫalḫalla

VII.13. *CT* 47, 62/62a Si 9/12/1 vente de champ de Lamassi, nadītum de Šamaš, et de Ipiq-Antum, fils de Nūr-ilīšu, son père, à Bēlessunu, nadītum de Šamaš, fille d'Ikūn-pī-Sin. L'acheteuse possède déjà un champ avoisinant.

La même personne achète dans *MHET* 606. Cette famille étend donc ses possessions dans cette région pendant le règne de Si.

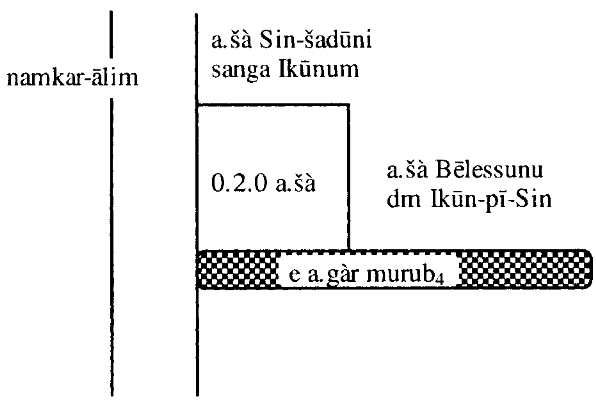
1. 0.2.0 iku a.šà a.gàr ḫal-ḫal-la^{ki}
2. *i-na qáb-li-i ša* lukur ^{d}utu
3. *i-ta* a.šà *be-le-sú-nu* ⌈dumu<munus>⌉ *i-ku-pí-sin*
4. *ù i-ta nam-kar* uru^{ki}
5. sag.bi.1.kam a.šà ^{d}EN.ZU-kur-*ni*
6. sanga ^{d}*i-ku-nu-um*
7. sag.bi.2.kam e a.gàr murub$_4$

Un champ de 2 eše (432 ares) est vendu. Il est situé dans l'*ugārum* Ḫalhalla, dans le Qablûm des prêtresses-nadītum (*ina* a.gàr Ḫalḫalla^{ki} *ina qablê ša* lukur ^{d}utu). Comment faut-il interpréter cette expression ? S'agit-il d'un champ 'au milieu' des prêtresses, ou dans (l'*ugārum*) Qablûm des prêtresses, où elles possèdent beaucoup de champs.

Note sur le nom Qablûm

Si ce champ se trouve dans l'*ugārum* Qablûm, ce n'est peut-être pas par hasard qu'il mesure 2 eše. En effet si nous considérons tous les noms d'*ugārums* qui se réfèrent à une certaine superficie de champ, nous obtenons un tableau allant de 1 eše à 3 eše (= 1 bùr) où il manque la catégorie de 2 eše, qui se situe exactement entre les deux autres. Le milieu étant '*qablûm*' pourrait-il s'agir de l'origine de ce nom ?

1.0.0	Burâ
0.2.0	[Qablê]
0.1.0	Eble



La présence d'un sanga d'Ikūnum concorde bien avec la localisation près de Ḫalḫalla où ce dieu est particulièrement vénéré.

Il est intéressant d'observer les positions relatives de la digue et du *namkarum*. Il ne s'agit pas d'un rehaussement longeant cette voie d'eau et sa fonction n'est donc pas d'endiguer les eaux de celle-ci. Elle se rapporte probablement à une autre voie d'eau à laquelle elle serait parallèle mais qui se trouve trop loin pour être mentionnée dans ce texte. Il s'agit probablement de la voie d'eau dans laquelle le *namkarum* prend son eau.

Le nom du *namkarum* renvoie à un lien direct avec la ville qui doit être Ḫalḫalla. Remarquons qu'il s'agit *du namkarum* de la ville. L'implication étant qu'il n'y en avait qu'un seul.

Le nom de la digue, la digue de l'*ugārum* du milieu, murub$_4$ = *qablûm*, pourrait indiquer qu'il s'agit d'une digue qui limite l'*ugārum*. Cela confirmerait la situation du champ dans Qablûm. Il semble cependant y avoir une contradiction. Jusqu'à nouvel ordre un *ugārum* ne peut se trouver dans un autre et le texte est clair : dans l'*ugārum* Ḫalḫalla, dans Qablê.

Si la digue de l'*ugārum* Qablûm délimite cet *ugārum*, le champ ne peut pas être dedans puisqu'il est dans l'*ugārum* Ḫalḫalla. L'*ugārum* Qablûm se trouverait alors de l'autre côté de la digue. La deuxième ligne est alors à comprendre, en prenant lukur comme un collectif, 'au milieu (des champs) des prêtresses *nadiātum* de Šamaš'.

VII.14. *MHET* 430 Si 15/1/[ ] vente de champ (la tablette contient la copie de deux ventes) de Muḫaddû et Awīl-[...] à Eli-eressa, nadītum de Šamaš [fille de ?].

1. ⸢x⸣ iku a.šà a.gàr ḫal-⸢ḫal⸣-[la^{ki}]
2. *i-ta nam-kar* [...]
3. *ù i-ta be-la-ki-*[*im* ...]
4. sag.bi.1.kam SIG-^{d}MAR.[TU]
5. sag.bi.2.kam.ma *ḫa-ab-*⸢x⸣-[...]

Un champ dont la superficie n'est plus lisible est vendu. Il se situe entre trois autres champs et jouxte un *namkarum* dont le nom est cassé. Il s'agit probablement du *namkar* ālim.

Vu le montant du prix, 3 mines d'argent, il doit s'être agi d'une grande superficie.

VII.15. *MHET* 627 s.d. (Sm-Ḫa) vente de terrain constructible de Sabībum, fils de [...], à Bēlessunu, nadītum de Šamaš, fille de Utu-zimu.

1. dub 8 sar é.ki.gál
2. *i-na* ḫal-ḫal-la^{ki}

3. egir é ^{d}EN.ZU-*i-qí-ša-am*
4. sag.1.kam *na-am-ka-* ⸢x x⸣
5. *i-mi-id*

Ce terrain non construit de 8 sar (2,88 ares) se trouve dans la ville de Ḫalḫalla même. Le texte situe le terrain entre une maison et le *namkarum* dont le nom est illisible. Faut-il restaurer *na-am-ka-*⸢*ar* uru⸣ ?

Ce texte montre qu'il y avait un *namkarum* qui passait par la ville de Ḫalḫalla même. Ce ne peut être que le *namkar* ālim dont le nom est ainsi expliqué. Cela concorde bien avec l'indication tirée des textes précédents selon laquelle un *ugārum* Ḫalḫalla^{ki} se situait le long d'une partie du *namkar* ālim.

Les textes du 'dossier Ḫalḫalla'

Dans les textes suivants la référence au *namkarum* n'est pas relatée à un *ugārum* nommé. Ils sont pourtant classés dans le dossier Ḫalḫalla par STOL (1998, 417-418) sur base des personnes mentionnées ou d'indications géographiques. Le dossier établi par cet auteur est assez large : il rassemble des textes mentionnant Ḫalḫalla-même, mais surtout des champs achetés ou donnés en bail par des personnes actives à Ḫalḫalla. Le domaine géographique de ces textes n'est donc pas exactement circonscrit mais doit être compris comme Ḫalḫalla et ses larges environs, sans que nous puissions déterminer l'étendue de ces environs. Selon le même auteur ce territoire engloberait les *ugārum*s Bāb ālim, Atanānum, Bar [...], Ša Binê, Eblê, Eribim, Gaminānum, Iškarum, (J)aḫdānum, Japsudum, Šalutānum, Šuplānum, taptiātum ša Ḫalḫalla, Tawirātum, Qablûm, Ubûm. Dans les environs se trouverait Lugalsagila.

VII.16. *MHET* 426 Si 14 échange de superficies. La première appartient à Sin-aḫam-iddinam, fils de Tuzālum, la seconde, composée de deux parties, à Ikūn-pī-Sin, fils de Sin-tajjar.

La première :

1. ⸢0.0.2⸣ iku 10 sar a.šà ⸢ú⸣.[sal ^{íd}ud.kib.nun ...]
2. *i-ta* e gu.la *ša i-ta a-*⸢*tap*⸣-[*pu*]-⸢*um*⸣ [...]
3. *i-ku-un-pi*$_4$*-sin* dumu *sin-ta-*⸢*ia*⸣*-ar*
4. *ù i-ta* ^{íd}ud.⸢kib⸣.nun⸢^{ki}⸣
5. sag.bi.1.kam *ia-ru-*⸢x-*ú*⸣
6. sag.bi.2.kam *a-tap-pu-um*
7. *ša* ⸢*i*⸣*-ku-un-pi*$_4$*-sin* dumu ⸢^{d}EN.ZU⸣*-ta-ia-*⸢*ar*⸣
8. *ù* a.šà *sin-šeš-i-din-nam* ⸢dumu⸣ *tu-za-lum*

est échangée contre :

11. 0.0.1 iku 6? sar a.šà ú.⸢sal⸣ $^{\text{íd}}$ud.⸢kib⸣.nun$^{\text{ki}}$
12. bal.⸢ri íd⸣
13. *i-ta* e gu.la
14. *ù i-ta* $^{\text{íd}}$ud.kib.⸢nun⸣$^{\text{ki}}$
15. ⸢sag⸣.bi.1.kam ⸢*nam*⸣*-kar a-*⸢*tá*⸣*-nu-um*
16. ⸢sag⸣.bi.2.kam a.šà ⸢x⸣*-ḫu-um-li-ši-ir*
17. ⸢dumu⸣ *ip-qú-ša*

et contre :

18. [0.0.1] iku ⸢ù? 4⸣ sar a.šà
19. ú.sal $^{\text{íd}}$ud.kib.nun$^{\text{ki}}$
20. bal.ri ⸢íd⸣
21. *i-ta* e ša *i-ku-un-pi$_4$-sin* dumu *sin-ta-*⸢*ia*⸣*-[ar]*
22. *ù i-ta* $^{\text{íd}}$ud.kib.nun$^{\text{ki}}$
23. sag.bi.1.kam *nam-kar a-tá-nu-um*
24. sag.bi.2.kam a.šà *be-la-*[...] dumu *ta-ri-bu-um*
25. šu.nígin 0.0.2 iku 10 sar a.šà

Schématiquement cela donne :

Deux superficies de 2 iku et 10 sar (75,6 ares) sont échangées.

La première est constituée par un champ, entre l'Euphrate et la Grande Digue (e gula). Les deux autres côtés sont formés l'un par Jaru et l'autre par l'*atappum* de Ikūn-pī-Sin et un champ.

La seconde superficie est composée de deux parties de 1 iku 6 sar et de 1 iku 4 sar respectivement.

Le champ de 1 iku 6 sar se situe également entre la Grande Digue et l'Euphrate. Par devant il y a le *namkar* Atānum, par derrière un autre champ. Bien qu'aucun nom d'*ugārum* ne soit mentionné, nous ne sommes donc pas loin de l'*ugārum* Atanānum (cfr notre II). D'autre part ce texte est classé dans le dossier Ḫalḫalla par STOL (1988, 418).

Ceci nous montre que le *namkar* Atānum part de l'Euphrate même. Le champ en question se situe entre l'Euphrate et la Grande Digue et sa situation est décrite comme ú.sal dans le texte. Celui-ci ajoute qu'il s'agit d'un emplacement de l'autre côté du fleuve (bal.ri íd). Le premier champ occuppe une position analogue mais il n'y a pas d'indication bal.ri íd, à moins qu'elle se trouvait sur la fin cassée de la première ligne.

Comme l'indication bal.ri íd suit immédiatement la mention de l'Euphrate, il ne peut y avoir de doute : le champ se situe au-delà de ce fleuve. Mais au-delà par rapport à quoi ?

Il s'agit du territoire au nord de l'Euphrate entre celui-ci et l'Irnina, donc de l'autre côté par rapport à Sippar-Jaḫrūrum.

L'autre partie, de 1 iku 4 sar, est également décrite comme ú.sal bal.ri íd, elle est également délimitée à l'avant par le *namkar* Atānum et à l'arrière par un autre champ. Elle se trouve également entre l'Euphrate et une digue, appelée la digue d'Ikūn-pī-Sin fils de Sin-tajjar.

La situation des deux parties est donc analogue : dans l'angle de l'Euphrate et du *namkarum* mais la digue est différente, en plus il s'agit évidemment de deux champs différents. Comment résoudre ce puzzle ? La seule solution possible est que les deux champs se situent tous deux le long de l'Euphrate mais chacun sur un côté opposé du *namkarum*.

Notons déjà qu'une partie de la digue le long de l'Euphrate s'appelait fort logiquement la Grande Digue mais qu'elle change de nom de l'autre côté du *namkarum*. Là elle s'appelle 'la digue d'Ikūn-pī-Sin fils de Sin-tajjar'.

Nous avons vu plus haut qu'un *namkarum* pouvait porter le nom d'une personne qui avait des propriétés le long de ses rives. Il apparaît ici que les *atappum*s et les digues aussi pouvaient recevoir des noms de la même façon et pour les mêmes raisons. Nous voyons en effet que cet Ikūn-pī-Sin était propriétaire des deux champs (un de 1 iku 4 sar et un autre de 1 iku 6 sar) qu'il échange contre celui de 2 iku et 10 sar, peut-être pour regrouper ses propriétés. Aucun champ limitrophe ne lui appartient mais nous sentons sa présence au travers de l'*atappum* qui porte son nom.

Deux morceaux jouxtant chacun l'Euphrate et le *namkarum* sont échangés contre un seul le long de l'Euphrate. En fait Sin-aḫam-iddinam échange un morceau de son champ et conserve la partie au-dessus.

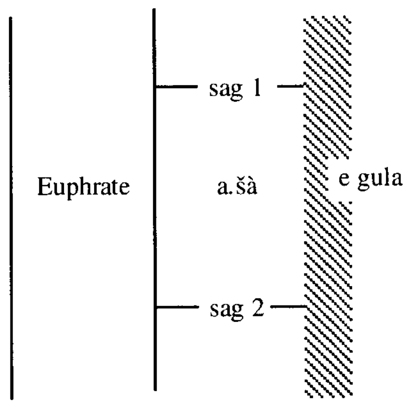
Les surfaces échangées sont identiques [13], leur valeur l'est également bien qu'on serait tenté de penser qu'un champ formant une unité serait plus avantageux que deux parties séparées. Celles-ci doivent donc présenter un avantage supplémentaire : ou bien leur position sur le terrain à l'entrée d'un *namkarum* ou bien le désir qu'avait Sin-aḫam-iddinam de les acquérir.

L'atappum Ikūn-pī-Sin

Le cours de l'*atappum* Ikūn-pī-Sin est bizarre : il coule le long de la Grande Digue, puis contourne la digue pour former une partie de l'avant du champ de 2 iku 10 sar. Une partie seulement puisque l'autre partie de l'avant de ce champ est formée par le champ de Sin-aḫam-iddinam. Nous ne savons pas si cette digue continuait au-delà.

Nous savons par un autre texte, *MHET* 606 (date perdue), que cet *atappum* provenait d'un *namkarum* dont le nom est illisible mais qui pourrait bien être le *namkar ālim* puisque *MHET* 606 est à situer dans Ḫalḫalla.

La présence du *namkar* Atānum pourrait signifier que nous sommes ici dans l'*ugārum* du même nom. Comme aucun nom d'*ugārum* est donné dans le texte, cela n'est pas exclu. Cela permettrait de situer un peu mieux cet *ugārum*. Sous Atanānum, plus haut, nous avions constaté que deux *namkarum*s se rejoignaient : l'Atānum et l'Abātum. Puisque nous savons maintenant que l'Atānum sort de l'Euphrate ce doit être la branche principale ; l'Abātum doit être dérivé de lui. Remarquons également que les champs situés entre l'Euphrate et sa digue sont désignés comme ú.sal. Comme nous connaissons la superficie des champs, nous pouvons ici aussi calculer la distance minimale et maximale qu'il y avait entre le cours d'eau et la digue.



[13] La surface à la ligne 18 du texte est cassée et non restaurée dans *MHET*. Si la première est de 1 iku 6 sar (ligne 11) et l'autre x iku et 4 sar il est quasiment certain que le nombre de iku manquant est 1, ce qui fait un total de 2 iku 10 sar, exactement le même que le champ échangé (ligne 1).

Nous avons trois surfaces. Pour chacune d'elles nous pouvons procéder à l'approximation suivante. Nous partons de l'idée que les champs sont rectangulaires. Les textes précisent que les petits côtés (sag) longent l'eau et la digue. Les grands côtés constituent donc la distance entre l'Euphrate et cette digue.

Au plus le champ se rapproche de la forme carrée, au plus petite cette distance. Nous prendrons donc comme distance minimale le côté du champ carré.

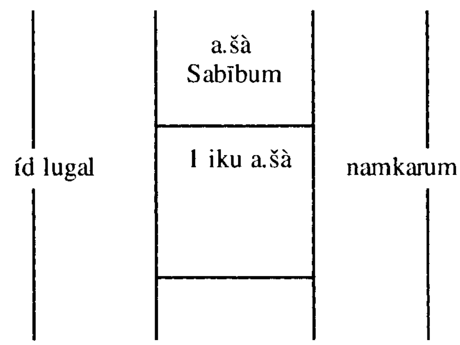
Au plus les grands côtés s'allongent au plus nous approchons de la distance maximale. Nous prendrons arbitrairement 10 m comme largeur minimale. Cela donne :

		longueur du grand côté	
surfaces	en m^2	si le champ est carré	si le petit côté fait 10 m
2 iku 10 sar	7560	86,95 m	756 m
1 iku 6 sar	3816	61,77 m	381,6 m
1 iku 4 sar	3744	61,19 m	374,4 m

Si nous supposons que la distance entre la digue et l'Euphrate est plus ou moins la même pour les trois champs, elle se situe entre 61 et 374 m du fleuve. Sinon la distance maximale peut atteindre 756 m.

VII.17. *CT* 47, 18 Sm vente de champ de Sabībum, fils de Ḫajabni-el à Ḫuzalātum, nadītum de Šamaš, fille d'Ilšu-abūšu, fils d'Utu-zimu. Ce même champ est revendu dans *MHET* 163, traité ci-dessous.

1. 0.0.1 iku a.⌜šà⌝ [...]
2. *li-ter li-im-ṭi ša* dingir-⌜x x x⌝
3. *i-ta nam-ka-rum ù i-ta* ⌜íd⌝ lugal
4. sag.bi a.šà *sa-bi-bu-um*



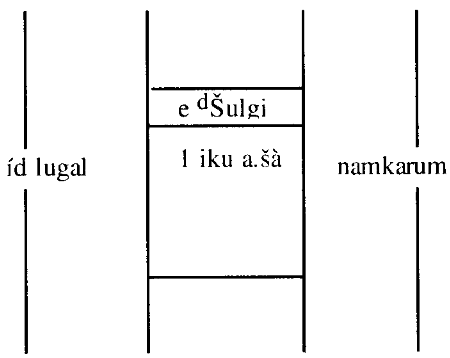
Un champ de 1 iku (36 ares) est vendu. Sa localisation dans un *ugārum* se trouvait peut-être sur la deuxième moitié, cassée, de la première ligne.

Il est situé entre le *namkarum* et le íd Lugal. Son voisin avant (sag.bi) est un autre champ. Un voisin arrière n'est pas mentionné.

Le champ est vendu à Ḫuzalātum fille de Ilšu-abūšu et le scribe a ajouté que ce dernier est le fils de Utu-zimu. Cette addition est exceptionnelle et on peut se demander quel en est le sens ici. Puisqu'il s'agit de la généalogie de l'acheteur ce ne peut être un renvoi à la documentation écrite précédente concernant le champ. La pratique courante peut être invoquée ici selon laquelle la fille (*nadītum*) achète mais le pater familias est considéré comme le véritable propriétaire. Vu sous cet angle c'est comme si le scribe avait voulu indiquer que Ḫuzalātum achetait au nom de Ilšu-abūšu fils d'Utu-zimu.

VII.18. *MHET* 163 Ḫa 11 — vente de deux champs de Ilšu-abūšū, fils d'Utu-zimu, à Sin-tajjar, fils d'Akšaja. Même champ que le précédent (*CT* 47, 18).

6. 0.0.1 iku (effacé) a.šà
7. *i-ta na-am-ka-ri-im*
8. *ù i-ta* íd lugal
9. sag.bi e ^{d}šul.gi



Avant ce champ le texte en mentionne un autre mesurant 1 bur (648 ares) et situé dans tawirtum '*ina* a.šà garim'. Comme le texte ne fait pas le total des deux il n'est pas sûr que le deuxième champ se situe aussi dans Tawirātum.

Le champ fait 1 iku (36 ares). Il se trouve entre le íd lugal et le *namkarum*, par devant il y a la digue de Šulgi.

Le champ de 1 iku est vendu par Ilšu-abūšu fils d'Utu-zimu. Le père, considéré comme le véritable propriétaire, vend donc un champ que sa fille avait acheté sous Sm.

Remarquons que dans le texte précédent la digue n'était pas mentionnée, sans doute parce que un des deux 'sag' était omis. Dans *MHET* 163 le champ voisin de Sabībum n'est pas mentionné mais bien la digue, l'autre 'sag' étant derechef omis.

Une autre différence entre les deux actes de vente c'est que dans le second, le scribe met le mot *namkarum* correctement au génitif.

Puisque nous connaissons la superficie du champ, il nous est possible de calculer la longueur approximative de cette digue comprise entre les deux cours d'eau.

Le champ fait 3600 m^2, s'il est carré il a donc 60 m de côté. S'il est rectangulaire nous considérons que la largeur minimale d'un champ devrait être de l'ordre de 10 m. La digue de Šulgi aurait donc une longueur entre 60 et 360 m.

Cette digue apparaît encore dans l'*ugārum* Dirītum :

MHET 98	Sm	parallèle à l'*atappum* ša Puzur-rabi
CT 2, 24	Ae	le même champ que le précédent (?) mais sans l'*atappum*

ainsi que dans l'*ugārum* Merigat :

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Il est donc clair que le e Šulgi est plus grand que la partie comprise entre le Šarrum et le *namkarum*. Selon toute probabilité elle continuait de l'autre côté du *namkarum* au moins.

Cette digue doit bien entendu longer le $^{\text{íd}}$Šulgi.

VII.19. *CT* 6, 33a Si 8/4/- héritage de Eli-eressa, nadītum de Šamaš, fille de Šamaš-ilum, à Bēlessunu, *nadītum* de Šamaš, fille de Nākarum.

4. 0.1.0 iku a.šà kankal *i-na* gú *nam-ka-rum*
5. *i-ta* a.šà *iṣ-ṣú-ri-ia*

Parmi les biens que Bēlessunu, prêtresse nadītum de Šamaš reçoit, il y a un champ de 1 eše (216 ares) 'ina gú *namkarum*', sur le flanc, la berge du *namkarum*, à côté d'un autre champ. Elle reçoit encore e.a. une maison à Ḫalḫalla, ce qui permettrait de croire que le champ devait se situer dans cette région. Le fait qu'elle reçoive aussi une maison dans le *gagûm* à Sippar ne change rien à cela : de nombreuses *nadiātum* de Šamaš vivant à Sippar possédaient des champs à Ḫalḫalla.

VII.20. *MHET* 729 [AS ?] probablement vente d'un champ de Erṣetīja fils de Raba[...], à Ḫuzalātum, fille d'Akšaja.

1. 0.2.0 iku a.šà *i-na* a x x x
2. *ša* lú ti-gi-la!$^{\text{ki}}$?

3. sag.bi *na-am-ka-ru-um*
4. ús.sa.du *da-qum* dumu *im-*⌈*gur-rum*⌉

Il s'agit encore d'un achat de Ḫuzalātum fille d'Akšaja. La localisation du champ est pratiquement illisible. STOL (1998, 432) propose de lire *i-na a-ta-pa-am ša* lú *Ti-gi-la* ki. Un *atappum* peut en effet être nommé d'après une personne et la lecture concorde bien avec les signes copiés en fin de volume de *MHET*. Il y a cependant trois anomalies : un champ serait '*ina*' un *atappum* ; le mot *atappum* serait à l'accusatif après *ina* ; ce même mot serait écrit défectueusement *a-ta-pa-am* au lieu de *a-ta-ap-pa-am*.

Il s'agit d'un texte du dossier d'Akšaja puisque sa fille achète le champ. Comme souvent, dans ce cas, le champ se situe à Ḫalḫalla, ce que nous savons e.a. par la présence comme témoin de Warad-Amurrim, sanga d'Ikūnum.

VII.21. *MHET* 326 Ḫa xx — vente d'un terrain constructible de Sin-erībam, fils de Sin-[...], à Sin-tajjar [...].

1. ⌈6⌉ sar é.ki.gál
2. *wa-ar-ka-at bi-ri-*⌈*tim*⌉
3. da é *a-wa-ti-*⌈*ia*⌉
4. *ù* da é ^{d}EN.ZU-*ri-*[...]
5. sag.bi.2.kam *na-am-ka-*[...]

Un terrain constructible (é ki.gál) de 6 sar est vendu.

De chaque côté il y a une maison, par devant le *namka*[ ]. Impossible donc de savoir s'il s'agit d'un *namkarum* nommé ou non.

Bien que cela ne soit pas explicitement dit, le terrain doit se situer à Ḫalḫalla, vu la présence comme témoin de Sin-šadūni fils du sanga d'Ikūnum Warad-Amurrim.

Voici donc après *MHET* 627 (notre VII.15) la deuxième référence à un *namkarum* en ville, frappé du même démon apocopeur que la précédente.

VII.22-23. *CT* 47, 13/13a Sm — vente de champ de Dadum, fils de Watar-Sin, à Ḫuzalātum [*nadītum* de Šamaš], fille d'Akšaja.

Case	Tablet
1. dub a.šà ú.sal *ma-la ma-ṣí-at*	1. a.šà-am ú.sal *ma-la ma-*<*ṣú*>*-ú*
2. *ki-ir-ba-na-am a-na na-ri-im*	2. *ki-ir-ba-na-am* 3. *a-na na-ri-im is-sú-uk*
3. ⌈*na*⌉*-si-ik iš-tu nam-ka-ri-im / e-ši-im*	4. *i-ta nam-ka-ri-*⌈*im*⌉ [(vacat ?)]
4. [*a*]*-di nam-ka-ri-im*	5. *la-bi-ri-*⌈*im*⌉ [...]
5. *ša-ap-li-im*	6. *i-ta nam-ka-ri-*⌈*im e*⌉*-*[*šim*]

Un champ de surface non décrite ('*mala maṣû*') et sans mention d'*ugārum*, est situé entre le *namkarum labīrum*, le vieux *namkarum*, et le *namkarum eššum*, le

nouveau. Sur l'enveloppe la description diffère sur un point : *labīrum* est remplacé par *šaplum*, inférieur ou en aval.

Le *namkarum* en aval, le vieux, est donc abandonné au profit d'un nouveau *namkarum* en amont. Hydrologiquement cela relève du bon sens voire de l'évidence même. Lorsqu'on abandonne l'embouchure existante, sans doute parce qu'elle ne fonctionne plus, on va prendre l'eau en amont et non en aval.

Les données du texte permettent de localiser le champ dans Ḫalḫalla (STOL 1998, 417).

Les personnes concernées sont à situer dans cette localité : e.a. le vendeur Dadušа. L'acheteur n'est autre que Ḫuzalātum, la fille d'Akšaja qui achète de nombreuses propriétés à Ḫalḫalla.

Remarquons enfin que le champ est décrit comme ú.sal et que la formule '*kirbānam ana nārim issuk*' est employée. Celle-ci comporte une variante intéressante sur l'enveloppe : le verbe n'y est pas au prétérit mais au permansif '*nasik*'. Pour une discussion de cette formule on se reportera à nos Conclusions (4. Du texte au champ).

VII.24. *CT* 47, 9 Sm 5?/6/- vente d'un champ de Sinjatum, fils de Būr-Nunu, à Amat-Šamaš, nadītum de Šamaš, fille de Bēlšunu, fils de Sin-rēmēni.

1. 0.1.0 iku a.šà *i*-⌜*na*⌝ [ ]
2. *i-ta* a.šà ⌜*ḫu*⌝-[*za-la-tum*]
3. dumu.munus *ak-ša-ia*
4. *ù i-ta* a.šà *be-el-šu-nu*
5. [1] ⌜kam⌝ sag.bi *nam-ka-ru-um*
6. [2] ⌜kam⌝ sag.bi *ša-aq-tum*

Un champ de 1 eše (216 ares) est vendu. Le nom de l'*ugārum* ou de la localité indiqué sur la première ligne du texte est cassé après '*ina*' mais la présence de Warad-Amurrim sanga de Ikūnum comme témoin et de Ḫuzalātum fille d'Akšaja comme voisine garantissent une localisation Ḫalḫalléenne. Le champ se situe entre deux autres. Par devant il y a le *namkarum*, par derrière le '*šaqtum*' [14].

Remarquons au passage qu'une nadītum achète et qu'ici aussi non seulement le nom de son père mais également celui de son grand-père sont donnés. Il s'agit sans doute d'une propriété familiale sous l'autorité du père.

VII.25. *CT* 47, 28/28a Ḫa 6 vente d'une aire de battage de Sin-erībam à Ḫuzalātum, nadītum de Šamaš, fille d'Akšaja.

[14] Selon le *CAD* s.v. : (a geographic feature) OB. La seule référence donnée est ce même texte.

1. 15 sar *maš-kán-nu-um*
2. *i-ta nam-ka-ru-um*
3. *ù i-ta šu-pí-ša*
4. sag úḫ^ki^-ia

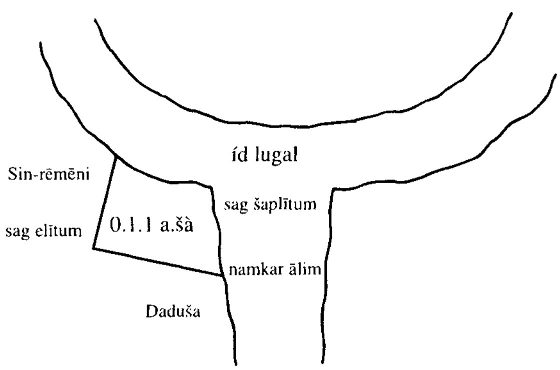
Une aire de battage de 15 sar (5,4 ares) est vendue à Ḫuzalātum fille d'Akšaja. Elle est située entre le *namkarum* et la propriété de Šupīša. Par devant il y a Akšaja.

Bien qu'il n'y soit pas fait mention d'un *ugārum*, nous pouvons localiser notre texte à Ḫalḫalla, vu la présence d'un membre de la famille Akšaja comme acheteur et du voisin Sin-šadūni fils du sanga d'Ikūnum Warad-Amurrim.

Notons finalement que l'aire de battage est située le long d'un cours d'eau.

VII.26. *MHET* 189 Ḫa 16/8/7 vente de deux champs de Šelēbum, Itūr-ašdum, Ḫammīja et Ḫabiṣum, fils de Sin-remēni, à Nīši-inīšu, nadītum de Šamaš, fille de Šupīša. Le deuxième champ est décrit comme suit :

7. 0.1.1 iku a.šà ú.sal 1.0.0 1/2 ma.na kù.babbar
8. ús.sa.du íd (effacé) lugal
9. ù ús.sa.du *da-du-ša*
10. sag.bi *e-li-tum* ^d^EN.ZU-*re-me-ni*
11. sag.bi *ša-ap-li-tum nam-ka-ar a-lim*

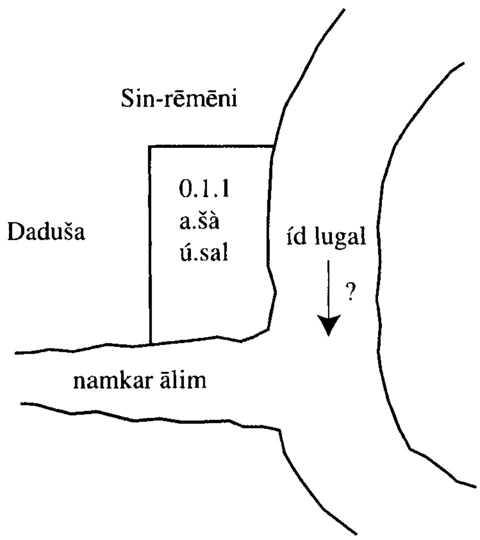


Ce champ mesure 0.1.1 iku (252 ares). Il se situe entre le íd Šarrum et un autre champ. En amont (sag *elītum*) il jouxte un troisième champ, en aval (sag *šaplītum*) le *namkarum* de la ville (*namkar ālim*). Malgré l'absence de localisation nous sommes certainement dans les environs de Ḫalḫalla avec le *namkar ālim*, et comme témoin, Sin-šadūni sanga d'Ikūnum (STOL 1998, 437).

Si nous traduisons *elītum/šaplītum* par amont et aval, cela nous donne une indication sur le sens du cours de la rivière Šarrum.

Plus important, ce texte montre que le *namkar ālim* part du ^íd^Šarrum.

Une intéressante comparaison de prix est également possible. Exceptionellement les prix des deux terrains qui y sont vendus sont exprimés par la valeur du bur. Le premier champ, situé entre une digue et le cours d'eau Akšak-gāmil vaut 1 mine par bur. Le deuxième, que nous avons cité, vaut exactement la moitié : 1/2 mine par bur. La différence entre les deux réside bien évidemment dans leur situation respective. Tous deux sont à côté d'un cours d'eau, ce qui est sans doute positif, la différence étant que le second se trouve dans un coin et est probablement beaucoup plus sujet à érosion. Cela explique son prix inférieur.



VII.27. *MHET* 172 Ḫa 14 vente de champ de Mār-Baja [...] à Ḫuzalātum fille d'Akšaja.

1. ⌈x⌉ + 0.0.4 iku a.šà ab.⌈sín⌉
2. ⌈*i*?-*na*?⌉ [...] ⌈x⌉ a bi? [...]
3. ša kaskal *kar*-^{d} [...]
4. *i*-⌈*ta*⌉ [...] *im-gur*-[...]
5. *ù i-ta* e ⌈*ša*⌉ [...]
6. ⌈sag⌉.bi.1.kam a-[...]
7. sag.bi.2.kam ⌈*nam*⌉-[...]
8. *i-na nam-kar* [...]
9. *ša* ti li PA [...]
10. *me-e i-ša*-[*qí* ...]

Encore un achat de Ḫuzalātum fille d'Akšaja et donc probablement un texte du dossier Ḫalḫalla sans que nous puissions préciser l'*ugārum*. Le texte est écrit à Sippar comme le prouve la présence de personnel du temple de Šamaš parmi les témoins.

De la surface du champ il ne reste que 4 iku de visible. Il s'agit d'un champ prêt à la culture (ab.sín). La localisation est perdue.

Le texte mentionne un kaskal *kar* ^{d}[...] qu'on pourrait peut-être compléter en Kār-Šamaš.

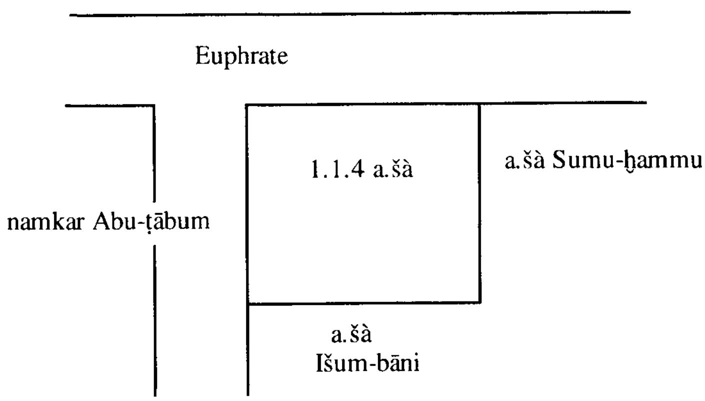
Un des côtés est une digue (e *ša* ...) et l'arrière est probablement un *namkarum* dont il ne reste plus que le premier signe. Il est précisé qu'elle prendra son eau dans un *namkarum* dont le nom est cassé et auquel on ajoute une qualification dans une relative malheureusement indéchiffrée dans *MHET.*

VIII. Ḫarbanî

VIII.28. *MHET* 901 — Aṣ 12/4/25 — extrait d'une vente de champ ; achat par la fille de Nūr-Kabta fils de Šamaš-bāni.

1. 1.1.4 iku a.šà
2. a.gàr *ḫar-ba-ni-i*^{ki}
3. *nam-ka-ru* šà ši-id-da-tim-ma
4. *i-ta* a.šà *sú-mu-ḫa-am-mu*
5. *ù i-ta nam-kar a-bu-ṭà-bu-um*
6. sag.bi.1.kam.ma ^{íd}ud.kib.nun^{ki}-*tum*
7. sag.bi.2.kam.ma a.šà ^{d}*i-šum-ba-ni*

Un grand champ de 1.1.4 bur (1.008 ares) est acheté. Il est situé dans l'*ugārum* Ḫarbāni [15]. D'un côté il y a un autre champ, de l'autre le *namkar* Abu-ṭâbum. Devant il est délimité par l'Euphrate (Purattum), derrière par un troisième champ :



Ce qui nous intéresse particulièrement ici, c'est que le *namkarum* d'Abu-ṭābum part de l'Euphrate.

[15] La ligne 3 nous est inintelligible.

Aucun propriétaire de ce nom n'est mentionné dans le texte. Ses champs doivent donc se situer ailleurs le long de ce *namkarum* ou alors le nom renvoie à une situation antérieure. Remarquons que notre base de données prosopographique de Sippar ne connaît d'Abu-ṭābum que sous Za/AS. Išum-bāni est un nom attesté sous Sm/Ḫa/Si. Le nom du deuxième voisin, Sumu-ḫammu est attesté dans des textes datant de Za, Sm et de Ḫa [16]. Il se pourrait donc bien que cet extrait concerne un texte bien plus ancien que la date qu'il porte.

Le champ se situe le long de l'Euphrate sans qu'il soit désigné comme ú.sal.

IX. Ḫaṣārum

IX.29. *MHET* 509 Aṣ 6/1/26 bail à ferme de Amat-Māmu, nadītum de Šamaš, fille de Awīl-Nabium.

5. 0.0.3 iku a.šà *i-ta* e *nam-ka*!*-ar* ⌈a⌉.gàr
6. *ù i-ta* a.šà *ib-ni*-^{d}MAR.TU

Deux champs sont baillés. Le deuxième fait 3 iku (108 ares) et est situé entre un autre champ et la digue du *namkarum* de l'*ugārum* (e *namkar* a.gàr).

Les deux champs, dont l'autre jouxte e.a. également une digue, la digue appelée 'les roseaux' 'e *qānu*', sont situés dans l'*ugārum* Ḫaṣāri faisant partie de la dépression de l'autre côté de la rivière '*šà na*-⌈*gi*⌉*-i bi-ri-it* íd' (l. 9). La même précision est donnée dans *BE* 6/1, 94 (Aṣ 3) : a.gàr *ḫa-ṣa-ri-im* šà *na-gu-um* bal.ri íd. Nous interprétons cette expression comme, de l'autre côté, au nord, de l'Irnina.

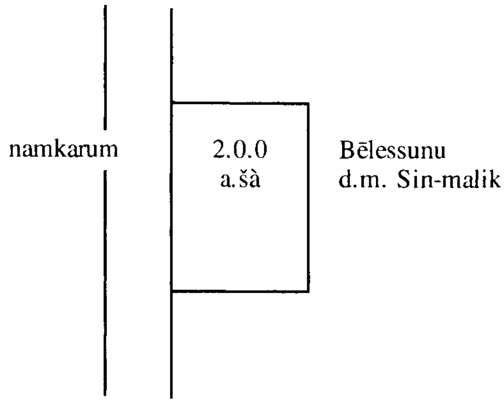
X. Iṣṣiātum

X.30. *MHET* 864 Si 5/10/20 partage de champs ; héritage de Nīši-inīšu *nadītum* de Šamaš, fille de Iballuṭ ; son héritière est Lamassāni, *nadītum* de Šamaš, fille de Šiqlānum.

4. 2.0.0 iku a.šà *i-na* a.gàr *iṣ-ṣí-a-tim*
5. šà a.šà *ši-qá-at*-^{d}*a-a*
6. *i-ta nam-ka-rum ù i-ta be*-⌈*le*⌉*-sú-nu* dumu.munus ^{d}EN.ZU-*ma-lik*

---

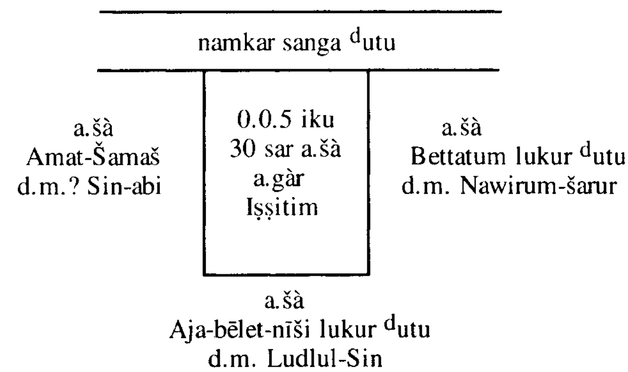
[16] *MHET* 26 daté de Za ; *CT* 6, 44c de Sm 14 ; *BDHP* 28 de Ḫa 13 ou Si 8 et *AbB* 12, 56 est une lettre sans date.



Un grand champ dans l'*ugārum* Iṣṣiātum 'šà a.šà Šiqat-Aja' faisant partie du champ de Šiqat-Aja, se trouve entre le *namkarum* et un autre champ. Ici aussi il s'agit de la partie centrale d'un champ, par suite de quoi les limites inférieure et supérieure ne sont pas indiquées puisque ce sont les parties appartenant encore à Šiqat-Aja

X.31. *JCS* 11, 23, 9 Si 9/7/6 vente de champ de Aja-bēlet-nīši, nadītum de Šamaš, fille de Ludlul-Sin, à Iltāni, nadītum de Šamaš, fille de Apil-ilīšu.

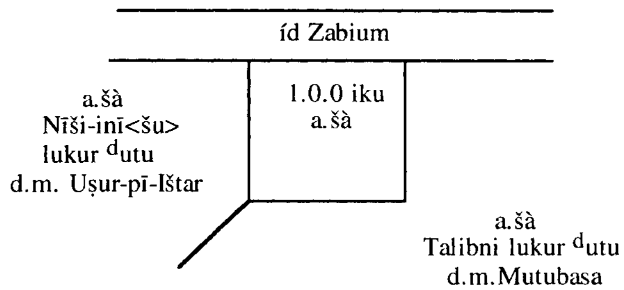
1. 0.0.5 iku 30 sar a.šà a.gàr *iṣ-ṣi-tim*
2. *i-ta* a.šà *be-ta-tum* lukur ^{d}utu
3. dumu.munus *na-wi-rum-ša-ru-ur*
4. *ù i-ta* a.šà géme-^{d}utu <dumu.munus> ^{d}EN.ZU-*a-bi*
5. *i-ta na-am-ka-ar* sanga ^{d}utu
6. *i-ta* a.šà ^{d}*a-a-be-le-et-ni-ši* lukur ^{d}utu
7. dumu.munus *lu-ud-lu-ul*-^{d}EN.ZU



Un champ de 5 iku et 30 sar (190,8 ares) est vendu. Il est situé dans l'*ugārum* Iṣṣiātum entre trois champs et le *namkar* sanga ^{d}utu.

X.31a *CT* 2, 5 Si 9/7/26 Il est intéressant de noter que la même Iltāni achète à la même Aja-bēlet-nīši, vingt jours plus tard, un autre champ dans Iṣṣitim (*CT* 2, 5).

Obv. 1. 1.0.0 iku a.šà *i-na* a.gàr *iṣ-ṣi-tim*
2. *i-ta* a.šà *ta-li-ib-ni* lukur ^{d}utu
3. dumu.munus *mu-tu-ba-sa*
4. *ù i-ta* a.šà *ni-ši-i-ni* lukur ^{d}utu
5. dumu.munus *ú-ṣur-pi-iš$_8$-tár*
6. sag.bi íd *za-bi-um*
7. *ki-ir-ba-nam a-na* íd *id-di*
8. sa.dul$_5$.bi a.šà *ta-li-ib-ni* lukur ^{d}utu
9. dumu.munus *mu-tu-ba-sa*
10. *a-na* pú *ša ta-mi-tim ú-ul ib-ba-al-ki-it*[17]
11. *i-na nam-ka-ri-ša ù ma-aš-qí-ti-ša*
12. *i-ma-ak-ka-ra*



Cette fois c'est 1 bur (6,48 ha) de champ situé entre deux autres appartenant à des *nadiātu*, l'avant du champ longeant le Zabium, dans lequel il 'a jeté une motte de terre'. Nous reviendrons plus loin sur le sens de cette expression.

Le *namkarum* ne peut pas être loin, car le texte ajoute, entre autres, *ina namkarīša u mašqitīša imakkara* "elles irrigueront à partir de son *namkarum* et de sa 'bouche d'irrigation'".

[17] On trouvera des interprétations diverses de cette ligne dans le CAD s.v. *būrtum, mašqītum, nabalkutum et namkarum.* Nous tendons plutôt vers une autre interprétation, partant de pú = *būrtum* et prenant alors *būrtum* dans le sens de 'déclaration sous serment' (CAD s.v. *būrtum* où ce passage n'est pas cité). Il s'agirait alors d'une formule garantissant que les stipulations sous serment ne seront pas transgressées.

X.32. *MHET* 477 Ae [ ] part d'héritage de Ilšu-bāni, fils de Sin-iddinam.

4'. 0.0.3 iku a.šà a.gàr *iṣ-ṣí-a-*⸢*tum*⸣*-ma*
5'. *i-ta* dumu.meš *ri-iš-*^{d}utu dumu ⸢x x x⸣ [...]
6'. *ù i-ta* a.šà *be-le-sú-nu* lukur ^{d}utu [...]
7'. sag.bi.1.kam.ma e $^{\text{íd}}$ud.kib.⸢nun$^{\text{ki}}$⸣ [...]
8'. sag.bi.2.kam.ma e *nam-ka-<rim> ša* dumu.meš [^{d}EN].ZU-*i-din-nam*

<table>
<tr><td colspan="3">e Euphrate</td></tr>
<tr><td>a.šà
Bēlessunu
lukur ^{d}utu
[...]</td><td>3 iku
a.šà</td><td>dumu.meš
Rīš-Šamaš
dumu [...]</td></tr>
<tr><td colspan="3">e namkarim ša dumu.meš Sin-iddinam</td></tr>
</table>

Plusieurs champs dans Iṣṣiātum sont énumérés comme les parts d'héritage, dans deux cas au moins, des fils de Sin-iddinam.

Un des champs mesure 3 iku (108 ares). Il se situe entre deux autres champs. Ce qui nous intéresse particulièrement ici, c'est que l'avant du champ est délimité par la digue (e) de l'Euphrate, l'arrière par la digue (e) du *namkarum* des descendants de Sin-iddinam.

La digue de l'Euphrate et celle de ce *namkarum* sont donc parallèles au moins pour une partie.

Le nom du *namkarum* est celui des descendants du propriétaire foncier dont les terres sont partagées dans le texte.

XI. Iškun-Ištar

XI.33. Di 1952 Si 11/12/1 échange de champs : Awīl-ilim, fils de Sin-iddinam échange avec Amat-Šamaš, fille de Sin-...

9. 0.0.4 iku a.šà a.gàr *iš-ku-un-iš*$_{8}$*-tár*
10. *i-ta* a.šà dingir-*šu-ba-ni* dumu *i-bi-*^{d}nin.šubur
11. *ù i-ta* a.šà (vacat)
12. sag.bi.1.kam íd *za-bi-um*
13. sag.bi.2.kam *nam-kar* dingir-*šu-ba-*⸢*ni*⸣

íd Zabium

a.šà	4 iku a.šà	a.šà Ilšu-bāni d. Ibbi-Ilabrat

namkar Ilšu-bāni

Un champ de 4 iku (144 ares) dans Iškun-Ištar est échangé. Devant il longe le íd Zabium, par derrière, le *namkar* Ilšu-bāni. Ce *namkarum* est donc — au moins en partie — parallèle avec le Zabium. Un des autres voisins est Ilšu-bāni, fils de Ibbi-Ilabrat, ce qui explique le nom du *namkarum*.

XII. Lugal-sagila

XII.34. *MHET* 191 Ḫa 17 vente d'un champ de Iltāni, fille de Beja, à Sin-tajjar, fils d'Akšaja.

1. 0.0.2 iku a.šà *ú-ša-lum*
2. *i-na ša* dingir-*na-šu-ri-eš*
3. *i-ta* ^{d}EN.ZU-⸢*ta-ia-ar*⸣ dumu *ak-ša /-ia*
4. *ù i-*⸢*ta*⸣ *nam-ka-rum*

enveloppe variante de la ligne 4 : *ù i-ta nam-ka-rum ša i-*⸢*bi*⸣-[*Sin*]

XII.35. *CT* 45 111 s.d. liste de propriétés immobilières que Iltāni, fille de Bēja, vend à Sin-tajjar, fils d'Akšaja.

22. 0.1.0 iku a.šà ú.sal *i-na* dingir-*na-ša-am-ri-iš*
23. *i-ta* a.šà ^{d}EN.ZU-*ta-ia-ar*
24. dumu *ak-ša-ia*
25. *ù i-ta nam-ka-rum ša i-bi-*^{d}EN.ZU

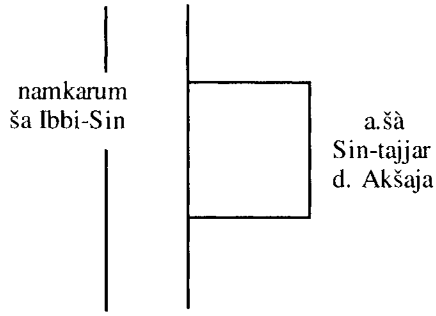
XII.36. *CT* 45, 113 s.d. liste de propriétés immobilières que Iltāni, fille de Bēlja, vend à Sin-tajjar, fils d'Akšaja.

26. 0.0.2 iku a.šà ú.sal *i-na na-šu-ri-iš*
27. *i-ta* ^{d}EN.ZU-*ta-ia-ar* dumu *ak-ša-ia*
28. *ù i-ta nam-ka-rum ša i-bi-*^{d}EN.ZU

XII.37. *MHET* 584 s.d. (post Ḫa 17) liste de propriétés immobilières que Iltāni, fille de Bēlīja vend à Sin-tajjar, fils d'Akšaja.

24. 0.0.2 iku a.šà ú.⸢sal *i*⸣-*na* ^{d}lugal.⸢sag.íl⸣.la
25. *i-ta* a.šà ^{d}EN.ZU-*ta-ia-ar* dumu *ak*-[*ša-ia*]
26. *ù i-ta nam-kar ša i-bi*-^{d}EN.⸢ZU⸣

Tous ces champs sont situés de même :



Les textes XII. 34 à 37 sont tous les mêmes à quelques variantes près. Ils donnent la liste de sept champs tous ú.sal, achetés e.a. à la famille Ibbi-Sin par la famille Akšaja sous Sm et Ḫa.

Un des champs est situé le long du *namkarum ša* Ibbi-Sin, où l'on voit encore que le *namkarum* est nommé d'après celui qui possédait là de nombreux champs. *MHET* 191 est le contrat original de vente de ce champ, daté Ḫa 17.

Notons que le contrat original donne le nom du *namkarum* sur l'enveloppe mais pas sur la tablette.

La situation des parcelles est décrite par rapport à Lugalsagila, au tawirtum de Ibbi-Sin et à la rive de l'Irnina, ce qui donne l'impression — mais pas la certitude — que ces données sont liées entre elles : Lugalsagila se trouverait alors près de l'Irnina et Ibbi-Sin y aurait eu des possessions étendues. Les textes témoignent probablement de la fin de cette fortune puisqu'ils témoignent de la vente des terrains à la famille Sin-tajjār.

La désignation a.šà gar.ra/*tawirtum* et a.gàr ne sont pas identiques. La première est plus restreinte que la seconde. Dans le cas de Lugalsagila les deux qualifications existent :

- ú.sal *ina* a.šà gar.ra/*tawirtim ša* ^{d}Lugalsagila, ou de façon raccourcie : ú.sal *ina* ^{d}Lugalsagila (dans les trois textes mentionnés ci-dessus).
- *MHET* 240 (Ḫa 13) fait partie de ce même groupe dans le sens où il donne la liste de trois achats de champs faits par Ḫuzalātum *nadītum* de Šamaš et fille d'Akšaja. Les champs sont situés *ina tawirtim ša* Lugalsagila et a.gàr Lugalsagila, le total de 1.0.4 iku (792 ares) est désigné comme a.gàr ^{d}Lugalsagila.

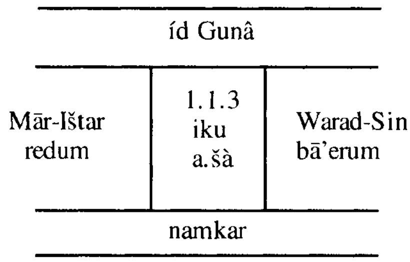
Remarquons encore que ces champs sont situés *ina* ú.sal à côté du *namkarum*. Cela doit signifier qu'ils se situent à l'endroit où le *namkarum* quitte le fleuve. Le nom de ce fleuve n'est indiqué sur aucun des textes.

XIII. Maḫana

XIII.38. *MHET* 683 s.d. extrait de contrat, donnant uniquement la localisation d'un champ.

1. 1.1.3 iku a.šà a.gàr *ma-a-na*
2. *i-*⸢*ta*⸣ ìr-^{d}EN.ZU *ba-e-rum*
3. *ù i-ta* dumu-*$iš_8$-tár re-di l-i*
4. sag.bi.1.kam.ma $^{\text{íd}}$*gu-na-a*
5. sag.bi.[2.kam.*ma*] *nam-ka-ar*

(le reste est anépigraphe)



Le champ mesure 1.1.3 iku (972 ares) et se trouve entre les champs de deux militaires, un *redû* et un *bā'erum*. Devant il y a le $^{\text{íd}}$Gunâ et derrière le *namkarum*. Les deux cours d'eau sont donc parallèles ici.

Nous nous trouvons dans un contexte militaire où, exceptionnellement, les soldats sont mentionnés par leur nom.

XIV. Tawirātum

XIV.39. *MHET* 427 Si 14/5/3+x vente d'un champ de Elmeštum, nadītum de Šamaš, fille de Adad-šarrum, à Bēlessunu, nadītum de Šamaš, fille d'Ikūn-pī-Sin.

1. 0.1.0 ⸢iku⸣ [a.šà a].gàr *ta-wi-ir-tum*
2. *i-*[*ta*] ⸢a⸣.šà ⸢^{d}EN.ZU⸣-*re-me-ni*
3. *ù i-ta* a.šà *na-kar-*⸢*tum* lukur⸣ [^{d}]⸢utu⸣
4. sag.bi.1.kam.ma *nam-kar-rum*
5. sag.bi.2.kam.ma Ilu-na-ìl[18]

[18] Suggestion de lecture de L. De Meyer ; MHET donne AN.NA.AN.

	namkarum	
a.šà Nakartum lukur ^{d}utu	0.1.0 iku a.šà	a.šà Sin-rēmēni
	Iluna-il	

Un champ de 1 eše (216 ares) dans l'*ugārum* Tawir(ā)tum est vendu. Il se situe entre deux autres champs. Par devant il jouxte le *namkarum*.

XV. Tenūnam

XV.40. *CT* 2, 37 Za vente d'un champ de Nanna-mansum et Sin-bāni, fils de Sin-abūšu, à Ilšu-bāni.

1. 0.0.4 1/2 iku a.šà *i-na e-bi-ir-tim*
2. *i-na ta-wi-ir-tim ša te-nu-<nam>*
3. *e-li-ti-im*
4. *i-ta qa-ra-ni-im* dumu é.gal
5. *ù i-ta ì-lí-mi-di*
6. sag.bi.1.kam kaskal *aš-ta-ba-*⌜*la*?⌝
7. sag.bi.2.kam *nam-kar-ru-um*
8. ša a.gàr *te-nu-nam*

	kaskal Aštabala	
Ili-midi	4 1/2 iku a.šà	Qarānum dumu é.gal
	namkarum ša a.gàr Tenūnam	

Un champ de 4 1/2 iku (162 ares) est vendu. Il se situe '*ina ebertim*' (ce qui est la traduction accadienne de bal.ri), '*ina tawirtim ša* Tenūnam *elītim*', de l'autre côté (de la rivière) dans le *tawirtum* du Tenūnam supérieur.

Le *tawirtum* désigne une partie d'*ugārum*, ce *tawirtum*-ci ne porte pas de nom de personne comme c'est souvent le cas mais il est spécifié quant à sa situation dans la partie supérieure de l'*ugārum*.

Le terme '*ebertum*' situe l'*ugārum* au nord de l'Irnina.

Autre précision importante : le champ en question est délimité à l'avant par une route, le kaskal Aštabala, et à l'arrière par le *namkarum* de l'*ugārum* Tenūnam (*namkarum ša* a.gàr Tenūnam).

XV.41. Di 680 Si 7/12/20 vente d'un champ de Amat-Aja, nadītum de Šamaš, fille d'Ipiq-Annunītum, à Amat-Mamu, nadītum de Šamaš, fille de Sin-ilum. Ce même champ est vendu quatorze ans plus tard (cfr Di 700 ci-dessous).

1. 0.1.5 1/2 iku [a].⌈šà⌉ a.gàr *te-nu-*⌈*nam*⌉
2. *i-ta* $^{\text{íd}}$ $^{\text{d}}$na-bi-um-ḫé.⌈gál⌉
3. *ki-ir-ba-nam a-na* íd *is-su-*⌈*uk*⌉
4. *ù i-ta* kislaḫ.meš
5. sag.bi.1.kam.ma ⌈*nam-kar*⌉ a.gàr *te-nu-*⌈*nam*⌉
6. sag.bi.2.kam.ma a.šà ⌈dumu-*iš*$_8$*-tár*⌉
7. dumu *i-šar-li-im*

Un champ de 0.1.5 1/2 iku (414 ares) est vendu. Il se situe dans l'*ugārum* Tenūnam, entre le $^{\text{íd}}$Nabium-ḫegal et les aires de battage (kislaḫ.meš). Par-devant il jouxte le *namkarum* de l'*ugārum* Tenūnam, par l'arrière un autre champ.

Ce texte nous montre donc que ce *namkarum* prend son eau dans le Nabium-ḫegal.

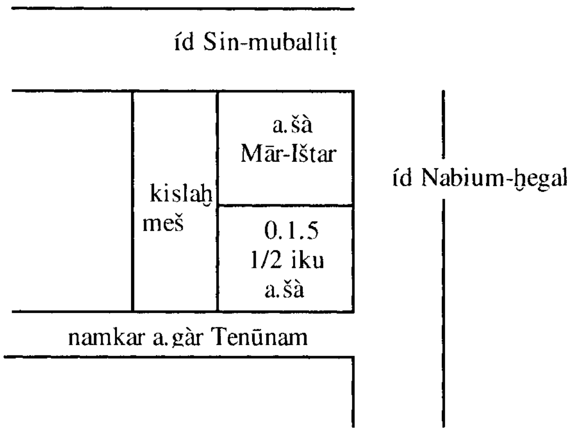
Remarquons au passage que les aires de battage se trouvent le long de l'eau, près d'un embranchement.

A la description du côté du Nabium-ḫegal, le texte ajoute la formule '*kirbānam ana nārim issuk*' que nous commenterons plus loin.

XV.42. Di 700 Si 21/10/15 vente d'un champ de Ikūn-pī-Sin, fils de Sin-tajjar, à Mār-Ištar, fils d'Išar-Lim.

1. 0.1.5 1/2 iku a.šà a.gàr *te-nu-nam*
2. bal.ri $^{\text{íd}}$*na-bi-um-*ḫé.gál
3. $^{\text{d}}$utu.šú.a
4. *i-ta* $^{\text{íd}}$*na-bi-um-*ḫé.gál

5. *ù i-ta* kislaḫ.meš
6. sag.bi.1.kam *nam-kar* a.gàr *te-nu-nam*
7. sag.bi.2.kam a.šà dumu-*iš*$_{8}$-*tár*
8. *ša a-na* dingir-dingir-*še-me-a* dumu ^{d}EN.ZU-*re-me-ni*
9. *ú-pí-iḫ-ḫu*



Le champ XV. 41 est donc encore vendu 14 ans plus tard, cette fois à un voisin, Mār-Ištar. Sa situation est à nouveau décrite de façon identique [19] sauf qu'on ajoute maintenant: de l'autre côté du ^{íd}Nabium-ḫegal, à l'est (bal.ri ^{íd} Nabium-ḫegal ^{d}utu.šú.a).

Remarquons au passage que le prix a fort baissé: en Si 7 il vaut 1 2/3 mines et 5 gín, en Si 21 il n'est plus que 2/3 de mine. En d'autres mots une baisse de plus de la moitié en quatorze ans.

XV.43. Di 686 Aṣ 4/2/1 certificat des descendants de Išar-Lim à Warad-Gipar et Sin-išmeanni, fils de Warad-Ulmaššītum.

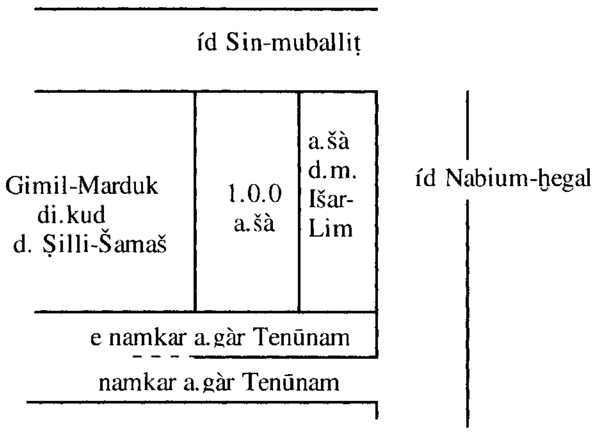
3. *ša* 1.0.0 iku a.šà šà 1.1.0 iku AN.ZA.GÀR ù kislaḫ
4. a.gàr *te-nu-nam*
5. šà a.šà.gar.ra *ša i-šar-li-im*

(historique du champ de 1.1.0)

11. *i-ta* a.šà *gi-mil*-^{d}AMAR.UTU di.kud dumu *ṣíl-lí*-^{d}utu
12. *ša* dumu.meš *i-šar-li-im i-ša-mu*

[19] On y a également ajouté une 'histoire du champ voisin', cfr M. TANRET, "The tablet and the field" et *Chains of Transmission* (tous deux sous presse).

13. *ù i-ta* a.šà dumu.meš *i-šar-li-im*
14. sag.bi.1.kam.ma íd ^{d}EN.ZU-*mu-ba-lí-iṭ*
15. sag.bi.2.kam.ma e *nam-kar* a.gàr *te-nu-nam*



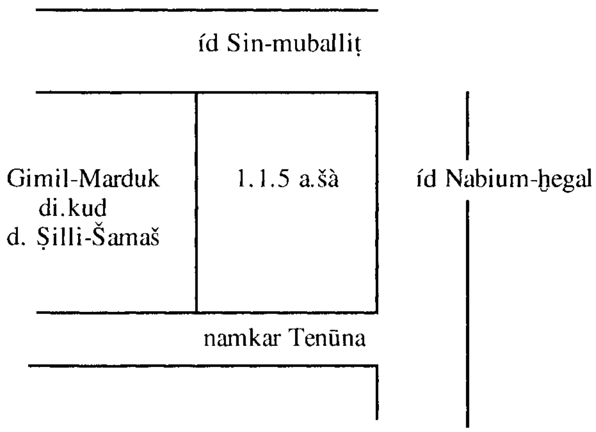
Ce document détaille la chaîne de transmission d'un champ de 1.0.0 bur dans Tenūnam, dans l'a.šà gar.ra/*tawirtum* d'Išar-Lim. Ce champ est délimité à l'avant par le íd Sin-muballiṭ et à l'arrière par la digue du *namkarum* de l'*ugārum* Tenūnam. Ces deux cours d'eau sont donc parallèles à cet endroit.

Il ne fait aucun doute, même si l'histoire des champs individuels décrits dans Di 680, Di 686, Di 700 et Di 691 est quelque peu complexe, que leur situation est la même. Ce qui nous intéresse particulièrement ici est que dans les textes datés avant Aṣ 4 (Di 680 Si 7, Di 700, Si 21) ces champs jouxtent le *namkarum*. Dans Di 686 (Aṣ 4/2/1) le *namkarum* est pourvu d'une digue à cet endroit. La conclusion est qu'entre Si 21 et Aṣ 4 une digue a été élevée ici. Cependant dans Di 691, daté trois mois et six jours plus tard, cette digue a disparu. Il pourrait bien s'agir là d'une imprécision puisque le texte est un bail à ferme et la formulation très succincte : *namkar* Tenūna vs le e *namkar* a.gàr Tenūnam de Di 686. Qui plus est, dans Di 386, s.d., la digue est mentionnée. Or, cet extrait copie, vu les voisins mentionnés, un document rédigé sous Ḫa. La copie est plus récente et doit dater de Ad/Aṣ ; le scribe pourrait donc avoir introduit un anachronisme mais cela fait déjà deux anomalies à expliquer.

XV.44.	Di 691	Aṣ 4/5/7	bail à ferme de Inanna-mansum, galamaḫ d'Annunītum, à Warad-Gipar, fils de Warad-Ulmaššītum, et Bēlānum, fils d'Inanna-mansum.

1. 1.1.5 iku a.šà ab.sín
2. a.gàr *te-nu-na*
3. *i-ta* ^{íd} ^{d}*na-bi-um*-ḫé.gál
4. *ù i-ta gi-mil*-^{d}AMAR.UTU di.kud
5. dumu *ṣíl-lí*-^{d}utu
6. sag.bi.1.kam íd ^{d}EN.ZU-*mu-ba-lí-iṭ*
7. sag.bi.2.kam *nam-kar te-nu-na*

Un champ cultivé (ab.sín) de 1.1.5 iku (10,44 hectares) dans l'*ugārum* Tenūnam est situé comme suit :



Cela nous permet de conclure que le *namkarum* de l'*ugārum* Tenūnam prenait son eau dans le Nabium-ḫegal. La relation entre le Nabium-ḫegal et le Sin-muballiṭ n'est pas claire : l'un dérive de l'autre mais lequel ?

Dans notre documentation le íd Sin-muballiṭ n'apparaît que dans Di 686, Di 691 et Di 386, toujours dans Tenūnam et en rapport ou bien avec le Nabium-ḫegal ou avec le *namkar* Tenūnam. Hors des archives de Ur-Utu on le retrouve une seule fois dans *CT* 47, 30/30a peut-être dans l'*ugārum* Merigat (si la ligne est à lire *mi-ig-ri-ga-ti*). Tout cela le situe avec certitude au nord de l'Irnina.

XV.45. Di 386 s.d. extrait de contrat donnant uniquement la localisation du champ.

1. 1.1.0 iku a.šà *i-na* ⸢a.gàr⸣ *te-nu-*⸢*nam*⸣
2. [*i*]-⸢*ta*⸣.a.[šà] [^{d}utu]-⸢*tillat*⸣-*su* dumu *itti*-^{d}EN.LÍL-*qí*-⸢*in*⸣-[*ni*]
3. ⸢*ù i-ta*⸣ a.šà ^{d}iškur-ma.an.sum dumu dingir-*šu-a-bu-šu*
4. sag.bi.1.kam.ma íd ^{d}EN.ZU-*mu-ba*-⸢*lí-iṭ* ⸣
5. sag.bi.2.kam.ma e *nam-ka*-⸢*ar*⸣
6. a.gàr *te-nu-nam*

7. 0.0.5 iku a.šà *i-na* a.gàr *te-nu-nam*
8. *i-ta* a.šà dumu.munus lugal
9. *ù i-ta* a.šà dumu.munus *zi-kir-pi*$_4$-^{d}EN.ZU
10. sag.bi.1.kam.ma ⸢íd⸣ ^{d}*na-bi-um*-ḫé.gál
11. sag.bi.2.kam.ma e *nam-ka-ar*
12. a.gàr *te-nu-nam*
13. šu.nígin 1.1.5 iku a.šà

Lo.E. 14. *i-na* a.gàr *te-nu-nam*

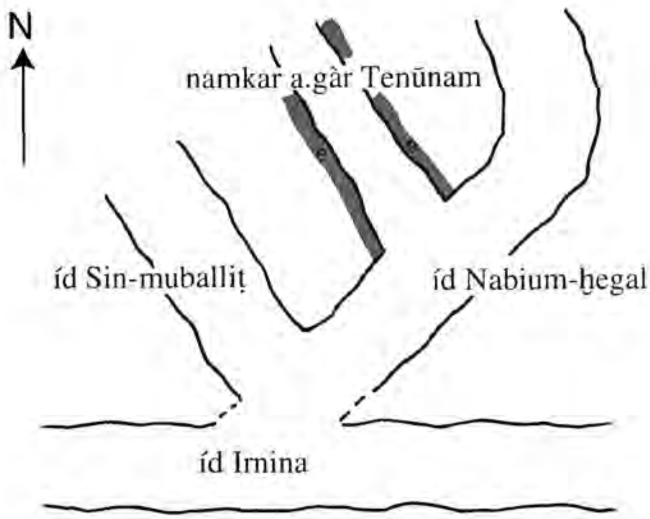
	íd Sin-muballiṭ	
a.šà Iškur-mansum d. Ilšu-abūšu	1.1.0 iku a.šà	a.šà Šamas-tillassu d. Itti-Enlil-qinni
	e namkar a.gàr Tenūnam	

	íd Nabium-ḫegal	
a.šà d.m. Zikir-pī-Sin	5 iku a.šà	a.šà d.m. lugal
	e namkar a.gàr Tenūnam	

Cet extrait donne la localisation de deux champs non avoisinants dans l'*ugārum* Tenūnam. L'un est grand, 1.1.0 (864 ares), situé entre le Sin-muballiṭ et la digue du *namkarum* de l'*ugārum* Tenūnam. L'autre est plus modeste : 5 iku (180 ares), situé entre le Nabium-ḫegal et la digue du *namkarum* de l'*ugārum* Tenūnam. A cet endroit aussi bien le Sin-muballiṭ que le Nabium-ḫegal sont parallèles à la digue du *namkarum*.

A en croire les dimensions des champs le íd Sin-muballiṭ serait quelque peu plus éloigné de la digue que le ^{íd}Nabium-ḫegal. Pour le premier cela correspond bien aux données du texte Di 691 commenté ci-dessus, où un champ légèrement plus grand, de 1.1.5, occupait une situation analogue.

Les données de ces deux textes peuvent être combinées dans le schéma suivant, donnant la position relative des quatre cours d'eau, le raccord avec l'Irnina étant hypothétique mais probable :



XV.46. *MHET* 332 Ḫa [ ]/4/18 ? vente (?) de deux (?) champs de Būr-Sin, fils de Ibbi-Ilabrat, à ? [...]tum, fille de Sin-[...] ; enveloppe non ouverte.

1. [... iku a].⌜šà⌝ kankal *i-na* ⌜a⌝.[gàr ...]
2. [*i-ta*] ⌜a.šà⌝ ᵈEN.ZU-⌜*ta-ia*⌝-[*ar*]
3. [*ù*] *i-ta* a.šà dumu.munus ⌜lugal⌝
4. [sag].bi.1.kam *nam-kar* a.gàr ⌜*te-nu*⌝-[*nam*]
5. [sag].⌜bi⌝.2.kam ^íd^7.silà.ta
6. [... iku] a.šà kankal *i-na* a.gàr ⌜*te*⌝-[*nu-nam*]
7. [*i-ta*] [a].šà dumu.munus *zi-kir-pi₄*-⌜ᵈEN⌝.[ZU]
8. [*ù i*]-*ta* a.šà *ì-lí*-⌜*ba-ni*⌝ x [...]
9. [sag].⌜bi⌝.1.kam *nam-kar* a.gàr *te-nu*-⌜*nam*⌝
10. [sag].⌜bi⌝.2.kam ^íd^7.⌜silà⌝.<ta>
11. [šu].⌜nígin⌝ 1.0.1 iku a.⌜šà⌝ ⌜kankal⌝

Ce texte fort abîmé décrit dans la partie conservée, deux champs spécifiés comme kankal, en friche, dont les dimensions sont à chaque fois perdues. Le total à la ligne 11 donne 1.0.1 iku (684 ares).

Le premier dont le nom d'*ugārum* est cassé mais qui se situe certainement dans Tenūnam, a deux autres champs comme voisins latéraux. Devant coule le *namkar* a.gàr Tenūnam et derrière le ^íd^ 7 silà.ta.

Pour le deuxième le nom d'*ugārum* est conservé : il s'agit bien de Tenūnam. Bien que situé entre deux autres champs que le premier, il fait également partie de la bande de terrain entre le *namkarum* de l'*ugārum* Tenūnam et le ^íd^ 7.silà.ta.

Ces deux cours d'eau sont parallèles au moins à cet endroit.

	namkar a.gàr Tenūnam	
a.šà d.m. lugal	[...] a.šà kankal	a.šà Sin-tajjār
	íd 7.silà.ta	

	namkar a.gàr Tenūnam	
a.šà Ili-bāni	[...] a.šà kankal	a.šà d.m. Zikir-pī-Sin
	íd 7.silà.ta	

Remarquons que ces deux champs ont chacun une voisine : la fille du roi et la fille de Zikir-pī-Sin qui sont les deux voisines latérales du champ de 5 iku dans l'extrait Di 386 daté *env.* Ḫa.

XVI. Ṭābum

XVI.47. *MHET* 675 s.d. (post Ad 29) liste et historique de champs achetés dans cet *ugārum* aux fils de Rīš-Šamaš par les fils d'Ilšu-ibni ; l'achat en question est daté de Ae "k" (les lignes 1-4 et 14-16 décrivent le même champ de la même façon).

1. 1.1.[0] [iku a.šà] *i-na* a.gàr *ṭà-bu-um*
2. *i-*⸢*ta*⸣ [dumu.munus [20]] dingir-*ḫa-*⸢*li*⸣ *ù i-ta nam-ka-*⸢*ri*⸣-[*im*]
3. sag.⸢bi⸣.[1.kam].ma a.šà [dumu.meš [21]] *ri-iš-*^{d}utu
4. sag.bi.2.kam.ma ⸢kaskal⸣ [*pa-ḫu*]-⸢*ṣum*⸣^{ki}

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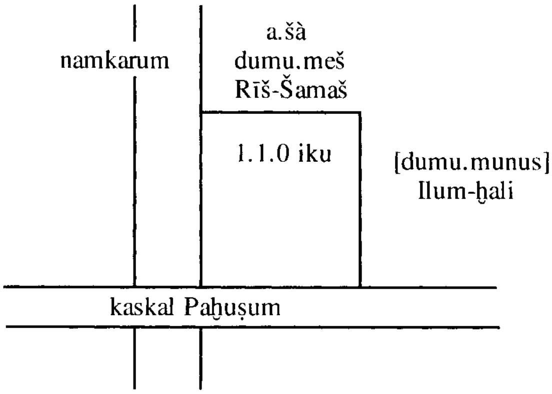
[20] L. Dekiere restaure 'a.šà', mais sur base de la ligne 14 du même texte il faut probablement lire 'dumu.munus'.

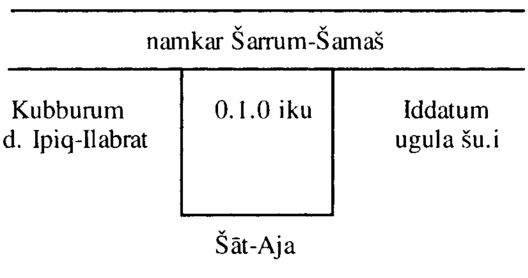
[21] Restauration sur base des lignes 7 et 10 du même texte, où on apprend que les noms de ces fils sont Ili-iddinam, Bunene-nāṣir et Ṣilli-Šamaš.



Un champ de 1.1.0 (864 ares) est situé entre un autre champ et le *namkarum.* Il est délimité par devant par un autre champ, à l'arrière il y a la route (kaskal) de Paḫuṣum. Cette dernière 'coupe' donc le *namkarum.* En réalité il est probable qu'il y a un pont ou peut-être un gué à cet endroit. La route de Paḫuṣum doit mener à la localité de ce nom.

XVI.48. *APR* 74 Aṣ 13/1/3 bail à ferme de Lamassāni et Tarībatum à Marduk-mušallim, fils du fameux Utul-Ištar abi eren.

7. 0.1.0 iku a.šà a.gàr *du-*⌜*na*$^{?}$- x a.gàr *ṭà-bu*⌝
8. *i-ta id-da-tum* ugula šu.⌜i⌝
9. *ù i-ta ku-ub-bu-rum* dumu SIG-^{d}nin.šubur$^{?}$
10. sag.bi.1.kam *nam-kar šar-rum-*^{d}utu
11. sag.bi.2.kam a.šà *ša-at-*^{d}*a-a*



Le texte mentionne deux champs, un dans l'*ugārum* Amurrum et celui-ci, qui sont donnés en bail ensemble.

La première ligne est peu claire. Il ne peut s'agir de deux *ugārums*.

Le nom du *namkarum*, Šarrum-Šamaš appartient à un type connu mais peu attesté dans la région de Sippar. Šarrum-Šamaš même est un hapax.

XVII. 0.1.3 iku

XVII.49. *CT* 4, 10 AS 1 liste de possessions immobilières (avec origine) de Lamassāni, prêtresse nadītum de Šamaš, fille de Abum-waqar.

7. 0.0.5 1/2 iku a.šà AN.ZA.GÀR ù kislaḫ a.gàr 0.1.3 iku.e
8. *i-ta* a.šà dumu.meš sagi (SÌLA.ŠU.DU$_8$) *ù i-ta* a.šà dumu.*meš a-bu-um-wa-qar*
9. sag.bi.1.kam ^{giš}kiri$_6$ dumu.meš *a-bu-um-wa-qar*
10. sag.bi.2.kam a.šà dumu.meš *a-bu-um-wa-qar*
11. *i-na nam-kar ra-ma-ni-šu me-e i-ša-at-ti*

Un champ de 0.0.5 1/2 iku (198 ares) avec 'tour' (AN.ZA.GÀR) et aire de battage dans l'*ugārum* 9 gán est décrit. Le *namkarum* ne délimite pas le champ. Il est cité pour indiquer que le propriétaire y puisera son eau.

Les vergers, la 'tour' et l'aire de battage indiquent la proximité d'un cours d'eau. Il est probable qu'il s'agit d'un *nārum*, sans doute celui d'où le *namkarum* tire son eau.

XVII.50. *BBVOT* 1, 114 Aṣ 11/1/22 bail à ferme de Lamassāni, nadītum de Šamaš, fille de Ili-malu[...] [22], à Nabium-mu[...].

1. [...]a.šà ab.sín
2. [...]⸢iku⸣ a.šà kankal
3. 0.0.4 iku a.šà a.gàr 0.1.⸢3⸣ iku.e
4. ⸢*li*⸣-*ib-bu* 1.0.0 iku[...]x[...]
5. *i-ta nam-kar ì-lí-iš-ti*?-⸢x⸣[...]

Un champ de 4 iku (144 ares) faisant partie d'un ensemble de 1 bur (648 ares) est situé le long d'un *namkarum*. Le nom du *namkarum* est cassé mais si nous lisons correctement *ì-lí-iš-*⸢*ti*⸣-⸢x⸣ il est probable — *pace* la copie — qu'il s'agit de Iliš-tikal, seule personne connue dont le nom commence par ces quatre signes. Nous connaissons une (et probablement une seule) personne de ce nom, fils de Hunnubum (*CT* 8, 12a Ḫa 3 ; *VS* 8, 17 AS ; *TCL* 1, 62 AS) et père de Erišti-Aja nadītum de Šamaš (de Sm 17 Di 2177 à Si 4, Di 2117), de Nūrum-liṣi (de Si 4, Di 2117 à Ad x, Di 2130) et de Šamaš-qarrad (Si 4, Di 2117). Iliš-tikal est attesté dans une dizaine de textes des archives d'Inanna-mansum qui forment le dossier de maisons à Sippar-Jaḫrūrum, près de la porte

22 A comparer avec *ì-lí-ma-lu-še*-⸢*im*?⸣ de *APR* 42.

de (Ma)nungal, le quartier des prêtres. Notre documentation ne nous permet pas de rattacher Iliš-tikal à aucune propriété champêtre et donc non plus à l'*ugārum* 9 gán.

S'il s'agit de cette personne, il faut constater que son nom est resté attaché à un *namkarum* depuis AS jusqu'à Aṣ.

XVIII. Sans nom d'*ugārum*

XVIII.51. Di 1458 Si [...] partage de biens immobiliers. Héritage de Lu-Ninsiana.

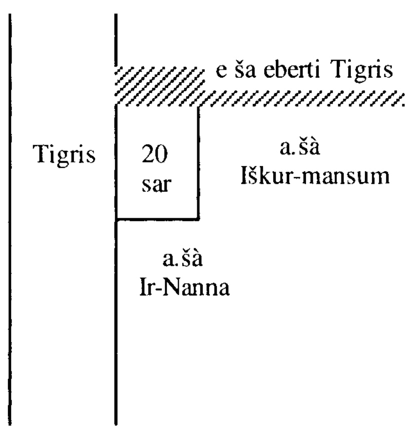
10′. 40 sar$^{!}$ $^{\text{giš}}$kiri$_6$ *i-ta* $^{\text{giš}}$kiri$_6$ dingir-*šu-ba-*⸢*ni*⸣
11′. *ù i-ta* $^{\text{íd}}$*nam-ka-rum*

Un des biens partagés est un verger ($^{\text{giš}}$*kirûm*) de 40 sar (43,20 ares) entre le verger d'Ilšu-bāni et le $^{\text{íd}}$*namkarum*. La localisation dans Ašukum n'est pas donnée explicitement mais quelques-unes des autres propriétés partagées s'y situent.

Remarquons le déterminatif $^{\text{íd}}$ devant *namkarum*, un hapax.

XVIII.52. *VS* 9, 19/20 Ḫa 22 vente d'un champ de Iškur-mansum, [fils de] Ilšu-abūšu, à Bēltāni, nadītum de Šamaš, fille de Sin-iddinam.

1. sag 1 ninda *a-na* 20 ninda uš
2. 20 sar a.šà *i-na nam-ka-*⸢*rum*⸣
3. *i-ta* a.šà $^{\text{d}}$iškur-⸢ma⸣.an.sum
4. *ù i-ta* $^{\text{íd}}$ ⸢idigna⸣
5. sag.bi.1.kam e *ša e-bi-ir-ti* $^{\text{íd}}$idigna
6. sag.bi.2.⸢kam⸣ a.šà ìr-$^{\text{d}}$lugal$^{?}$



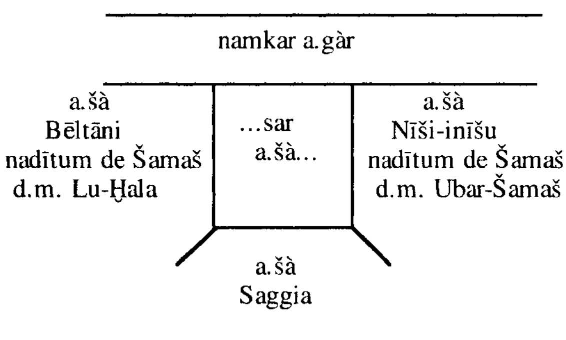
Un petit champ de 20 sar (7,20 ares) est vendu. Le texte spécifie sa largeur et sa longueur : 1 ninda (= 6 m) sur 20 ninda (= 120 m). Il est situé entre le Tigre et un autre champ. Par devant il est délimité par la 'digue de l'autre côté du Tigre' (e *ša eberti* ^{íd}Idigna). Nulle trace donc de *namkarum*. Cependant à la ligne 2 il y a la mention cryptique '*ina namkarum*' (dans le *namkarum*) [23].

Si les deux voisins ne sont pas pourvus de patronymes, il y a une bonne raison à cela : le voisin de droite est le vendeur et celui du bas son frère, comme nous l'apprend la liste des témoins. En fait Iškur-mansum vend une petite partie de son champ, celle qui longe le Tigre.

Il est remarquable de constater qu'il y a une digue qui forme un angle droit avec le Tigre. Il est plus remarquable encore que cette digue, d'après son nom, se situe à l'est du Tigre. Si le texte ne nous apprend rien de plus sur les *namkarum*s, il montre que la rive gauche du Tigre était prise en culture par les habitants de Sippar.

XVIII.53. Di 1131 Si 2 vente d'un champ de Saggia, fils de Narām-Sin à Eli-eressa, nadītum de Šamaš, fille de Sin-nūr-mātim.

1´. [...] ⌈sar a⌉.[šà ...]
2´. 5 ninda uš ⌈x x⌉ [...] ⌈x⌉
3´. *i-ta* a.šà *be-el-ta-ni* lukur ^{d}utu
4´. dumu.munus lú ú-ru *ḫa-la*^{ki}
5´. *ù i-ta* a.šà *ni-ši-i-ni-šu* lukur ^{d}utu
6´. dumu.munus *u-bar-*^{d}utu
7´. sag.bi.1.kam *nam-kar* a.gàr
8´. sag.bi.2.kam a.šà *sag-gi-ia*



[23] A comparer avec le tout aussi énigmatique 'ina atapam?' de CT 6, 33a (notre VII.19).

Un petit champ, puisque mesuré en sar, dont la superficie et la localisation sont perdues, est vendu. Il ne reste qu'une mesure : 5 ninda uš [...], 30 m de côté. Puisque 3600 sar font un iku, l'autre côté du champ doit mesurer moins de 120 m. Il est situé entre trois autres champs et le *namkarum* d'un *ugārum* non nommé (*namkar* a.gàr). Puisque le vendeur est aussi le voisin inférieur, celui-ci vend en fait une partie de son champ, plus précisément la partie qui longe le *namkarum*.

Comme les voisins et les contractants n'apparaissent pas ailleurs il est difficile de cerner davantage la localisation de cet *ugārum*. Les noms des témoins sont pratiquement tous illisibles.

La locution *namkarum* de l'*ugārum* est employée dans Ḫaṣārum ainsi que dans Tenūnam mais là jamais sans le nom de l'*ugārum*.

XVIII.54. *TLB* I, 225 Ae xx genre ? Propriétaire : Erišti-Aja.

1. a.šà *qá-qá-*⌜*di*⌝*-tum*?
2. ... bi ... ...
3. *iš-tu a-tap-*⌜*pí*?*-im*?⌝ x x
4. *a-di nam-ka-ri* ⌜x⌝ [ ] ⌜x⌝ ... ... [ ]

Ce texte très fragmentaire mentionne 'de l'*atappum...* au *namkarum...*' sans localisation possible. Notons simplement la proximité de ces deux cours d'eau et le fait qu'ils sont parallèles à cet endroit.

XVIII.55. *MHET* 689 date cassée bail à ferme de Ipiq-Išḫara, fils de Abum-ilum à Awīl-Adad, fils de Šumma-Šamaš.

1. 0.1.2 iku a.šà [...]
2. *i-ta na-am-ka-*⌜*ri*⌝*-*[*im*]

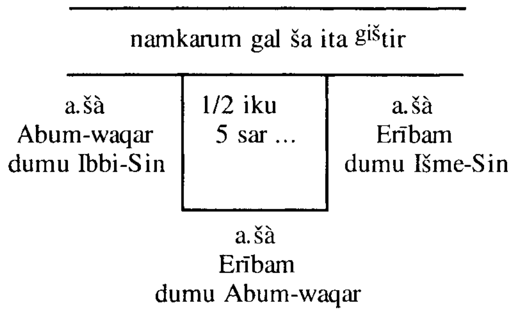
Peut-être la localisation de ce champ se trouvait-elle dans la partie cassée de la première ligne. Un seul voisin est donné : le *namkarum*.

Le montant du bail est de 4.3.2.0 d'orge pour 0.1.2 (28,8 ares) de surface ce qui est beaucoup, cp. 2.3.2.0 gur pour la même surface (Di 1066).

XVIII.56. *MHET* 584 (= *CT* 45 111 35-41 et *CT* 45 113 39-46) vente de propriétés de Nūr-aḫḫi et Abum-waqar, fils de Ibbi-Sin, à Erišti-Šamaš, fille de Sin-tajjar.

36. [1/2] iku 5 sar a.šà ⌜ú⌝.sal *i-na* gú ^íd^ir-ni-na
37. [1 1/3] ⌜sar AN.ZA.GÀR⌝ 3 1/3 sar <*ka*>-⌜*wa*⌝*-ru-ú*
38. [*li-tir*] ⌜*li-im-ṭi* é *ša e-ri-ba-am-ma*⌝

39. [*i-ta* a].šà ⸢*e-ri*⸣*-ba-am* dumu *iš-me-*^{d}EN.ZU
40. [*ù i-ta*] ⸢a.šà⸣ *a-bu-um-wa-qar* dumu *i-bi-*^{d}EN.ZU
41. [sag.bi.1].⸢kam⸣ *nam-ka-rum* [gal[24]] *ša i-ta* ^{giš}tir
42. [sag.bi.2].kam a.šà ⸢*e-ri-ba-am*⸣*-ma* ⸢dumu *a-bu*⸣*-um-wa-*⸢*qar*⸣



Un des champs énumérés se trouve le long du grand *namkarum* à côté du 'bois'.

Dans huit textes seulement de notre corpus apparaît un ^{giš}tir et il y a lieu de supposer qu'il s'agit du même bois dans plusieurs cas.

MHET 925 (*ca* Ḫa) localise un champ 'a.gàr Nagûm *pāni* ^{giš}tir', dans l'*ugārum* Nagûm, en face du 'bois'.

Dans *OLA* 21, 95 (Si 22) nous lisons 'a.gàr Merigat^{ki} *libbu teptītim ša pāni* ^{giš}tir' dans l'*ugārum* Merigat parmi les champs préparés à la culture qui se trouvent face au 'bois'.

MHET 431 (Si 15) et *BE* 6/II, 83 (Ad 31) mentionnent même un *ugārum* qui porte le nom 'a.gàr igi/*pa-ni* ^{giš}tir'.

Comme nous avons constaté plus haut, Nagûm et Merigat se trouvent tous deux au nord de l'Irnina. La qualification 'igi/*pāni*', en face, pourrait bien signifier que le 'bois' se trouvait face à eux, au sud et le long de l'Irnina. L'*ugārum* 'Pāni tīrim', en face du bois, se trouverait alors lui aussi au nord de l'Irnina.

Notre grand *namkarum* qui est à côté (pas en face) du 'bois' se trouverait alors également au sud de l'Irnina. Cette localisation a l'avantage de convenir aussi pour l'*ugārum* Lugalsagila dont tous les champs cités dans *CT* 45, 111, 113 et *MHET* 584 faisaient probablement partie.

[24] Restauré sur base de *CT* 45, 111 : 15.

IV. CONCLUSIONS

Les données textuelles réunies

Que pouvons-nous conclure des commentaires sur les attestations du mot *namkarum* dans les textes documentaires sippariotes paléo-babyloniens ? Nous réunirons d'abord ce que les textes nous apprennent avant de franchir le pas vers la carte.

1. Les noms des *namkarum*s

Le tableau ci-dessous donne un aperçu de tous les *namkarum*s avec ou sans nom, classés par *ugārum* :

ugārum	dates	textes	sans nom	Personne	*ugārum*	autres
Ašukum	Si, Ad, Aṣ	3	2	dumu.meš Awīl-Šamaš		
(Ḫ)atā(na)num	Si	1	—	Abātum et Atānum [25]		
(ša) Bīnum	Sm, s.d.	2	1	Abātum		
Eble	AS	3	2			xxx-a
Gami/anānum	pré-Ḫa	1	1			
(uru) gula	Aṣ	1	—			aga.uš.meš
Ḫalḫalla	Sm-Ḫa, Si	3	2			*ālim*
'dos. Ḫalhalla'	AS, Sm, Ḫa, Si	12	10	Atānum		*ālim*
Ḫarbanî	Aṣ	1	—	Abu-Ṭābum		
Ḫaṣārum	Aṣ	1	—		a.gàr	
Iṣṣiātum	Si - Ae	3	1	dumu.meš Sin-iddinam		sanga Šamaš
Iškun-Ištar	Si	1	—	Ilšu-bāni		
Lugalsagila	Ḫa	4	—	Ibbi-Sin		
Maḫana	s.d.	1	1			
Tawirātum	Si	1	1			
Tenūnam	Za - Aṣ 4	7	—		(e)a.gàr Tenūnam	
Ṭābum	Ae - Aṣ 13	2	1	Šarrum-Šamaš		
0.1.3 iku	AS - Aṣ 11	2	1	Iliš-ti[kal?]		
sans nom		6	4		a.gàr	gal *ša ita*^{giš}tir
Total		55	27	10	3	6

Les principes régissant la nomenclature de ces cours d'eau semblent être les suivants :

– de ceux qui portent un nom, la plus grande partie portent un nom de personne. Nous avons pu identifier la plupart de ces personnes comme des propriétaires

[25] Abātum et Atānum sont pris ici comme noms de personnes probablement Amorites sans certitude : Abātum est repris par Gelb (1980) ce qui n'est pas le cas pour Atānum ou ses variantes.

fonciers qui possédaient des champs le long d'un *namkarum*. Impossible de savoir si le *namkarum* à leur nom impliquait quelque droit (de propriété de quelque sorte) ou quelque obligation (d'entretien) de cette voie d'eau. L'emploi de la formule '*ina namkar ramānīšu mê išatti*' [26] "le champ prend de l'eau dans son propre *namkarum*", trop isolé, ne permet pas de conclure dans un sens ou dans l'autre. Remarquons aussi que ces noms sont ceux de personnes privées, tout au plus un sanga, jamais de nom de roi. Certaines rivières par contre portent des noms de rois : le íd Zabium, le íd Sin-muballiṭ ou renvoient au roi en général : le íd lugal. Par ce biais également la différence est exprimée entre les *nārum*s plus importants et les *namkarum*s qui le sont moins.

- les deux noms de profession : le *namkarum* du sanga de Šamaš et le *namkarum* des soldats suivent le même principe : s'il est vrai que Sin-iddinam est un sanga de Šamaš les deux noms du *namkarum* d'Iṣṣiātum se réduisent à un seul. Les 'soldats' sont évidemment cités comme groupe possédant des champs près du *namkarum* de (uru) Gula.
- les noms '*namkarum* de l'*ugārum*', '- de l'*ugārum* Tenūnam' ou 'à côté du grand "bois"' sont d'un autre type : se sont des noms descriptifs de la situation de ces cours d'eau.

Vingt-sept attestations — la moitié — ne sont pas spécifiées par un nom et de celles qui en portent un, deux qualifient le *namkarum* en question comme 'celui de l'*ugārum*'. Remarquons que même là où le *namkarum* avait un nom, noté sur l'enveloppe, celui-ci pouvait être omis sur la tablette, comme c'est le cas dans *MHET* 191. Dans tous ces cas on pourrait conclure qu'il n'y avait pas de confusion possible parce qu'il n'y avait qu'un *namkarum* par *ugārum*.

Il y a à cela deux exceptions. Le *namkarum* Abātum est cité dans deux *ugārum*s : Atanānum et ša Bīnum. Nous avons montré plus haut que ce *namkarum* coulait en fait entre ces deux *ugārum*s et pouvait en constituer (en partie ?) la délimitation. Abātum n'est donc pas véritablement dans les deux *ugārum*s.

La seconde exception a déjà été neutralisée plus haut : dans l'*ugārum* Iṣṣiātum il y a un *namkarum* des fils de Sin-iddinam et un *namkarum* du sanga de Šamaš. Puisqu'il y a un Sin-iddinam sanga de Šamaš les deux noms pourraient désigner le même *namkarum*. Cela nous montre que le nom d'un *namkarum* pouvait être mis à jour : c'est d'abord celui du sanga (Si 9) puis de ses descendants (Ae).

En général nous pouvons nous demander si les *namkarum*s dotés d'un nom de personne pouvaient changer de nom lorsque les terres passaient d'un grand propriétaire

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[26] Dans *CT* 4, 10, il s'agit d'un champ qui ne longe pas le *namkarum*, cas pour lequel il peut être utile de stipuler d'où il peut tirer son eau, mais pourquoi est-ce stipulé seulement ici ? L'emploi de formules parallèles avec *namkarum* et *mašqītum*, *atappum* ou pa$_5$, combinées avec les verbes *šatû*, *šaqû* ou *makāru* est également rare.

à un autre ou si ce nom était donné dés l'origine du *namkarum* et était conservé jusqu'à sa disparition [27]. Une indication est fournie par la dénomination sanga de Šamaš qui pourrait avoir changé en 'descendants de Sin-iddinam', une formule qui pouvait évidemment être utilisée pendant longtemps. Mais que savons-nous de la longévité de ces voies d'eau ?

2. La durée de vie d'un *namkarum*

Nous avons trouvé des *namkarums* dans les textes datés de Za jusqu'à Aṣ. Dans quelques rares cas nous avons plusieurs textes mentionnant le même *namkarum* nommé :

	attesté de	*à*	
namkar Abātum	env. Sm [28]	Si 13/9/10 (*MHET* 425)	= maximum 76 ans
namkar a.gàr Tenūnam	Za (*CT* 2, 37)	Aṣ 4 (Di 691)	= maximum 202 ans
namkar Atānum	Si 13 (*MHET* 425)	Si 14 (*MHET* 426)	
namkar sanga Šamaš/ dumu.meš Sin-iddinam	Si 9	Ae	= maximum 57 ans

Dans l'*ugārum* Ṭābum un *namkarum* sans nom apparaît sous Ae, nommé Šarrum-Šamaš on le trouve dans un texte daté de Aṣ 13. S'il s'agit du même il serait documenté sur 78 ans maximum.

De même, dans 9 gán un *namkarum* sans nom apparaît en AS 1, le namkarum Ilišti[kal?] est daté de Aṣ 11 ; cela fait 194 ans.

Il est bien évident que les chiffres ci-dessus ne nous renseignent que sur la durée minimale de ces *namkarums* : ils peuvent avoir existé avant et après ce que le hasard des textes nous livre.

Dans un cas nous sommes un peu mieux renseignés. Il s'agit d'un des dossiers de nos 'Chains of Transmission'.

Ur-Utu achète un champ dans l'*ugārum* Paḫuṣum en Aṣ 11. Celui-ci est entouré de quatre autres champs et ne longe donc pas un *namkarum*. Dans les archives d'Ur-Utu nous avons retrouvé les autres documents se rapportant à cet achat. Il s'agissait à l'origine de quatre champs adjacents, vendus à Ur-Utu comme un ensemble. Le document de transmission d'une des quatre parties, un contrat d'échange daté Si 11,

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[27] Le même problème se pose évidemment pour les *nārātum* pourvus de noms de rois. Une rivière avec un tel nom signifie sans doute que le roi y a fait effectuer de grands travaux, souvent répertoriés dans un nom d'année, mais comment s'appelait ce cours d'eau avant cela ?

[28] A cause de la voisine Ṣiriḫatum que nous trouvons aussi dans *MHET* 99 daté de Sm.

donne comme un des voisins le *namkar* Ilšu-bāni, fils de Ibbi-Ilabrat. Force est de conclure qu'entre Si 11 et Aṣ 11, une période de 103 ans, le *namkarum* a disparu.

Ici encore, nous ne pouvons déterminer combien de temps avant notre première attestation en Si 11 le *namkarum* existait, ni combien de temps avant Aṣ 11 il avait disparu, mais ce siècle est le terme le plus précis que nous puissions déterminer à partir de notre corpus.

Remarquons enfin que ce que les textes nous livrent sont les noms de ces cours d'eau. Les levées qu'ils ont formées et qui témoignent pour nous de leur présence aujourd'hui encore, une fois constituées n'ont sans doute jamais été effacées et ont pu être réutilisées (de façon continue ou avec intermittence) comme il a été indiqué dans la contribution de Cole et Gasche dans ce volume.

Ce que le nom ou la simple mention d'un *namkarum* non nommé nous révèle c'est que la levée était à ce moment-là 'vivante', c.-à-d. porteuse d'un cours d'eau.

La question posée plus haut quant à la permanence des noms d'*ugārum* ne peut malheureusement être résolue dans l'état actuel de notre corpus.

3. L'ordre de grandeur des *namkarum*s

Le *CAD* [29] cite un passage d'un texte astronomique tardif (ACh. Suppl. Adad 60 : 3), qui situe l'ordre de grandeur relatif des *namkarums* :

namgaru itti íd	le *namkarum* sera séparé de la rivière
atappi itti namgari..inakkiruma	l'*atappum* du *namkarum*
PA_5 *atappīša*	et le PA_5 de son *atappum*

Les *namkarum*s, selon ce texte, sont donc des voies d'eau de second ordre, après les rivières (íd/*nārum*s) et avant les *atappum*s et PA_5.

Cette situation était-elle la même pendant la période paléo-babylonienne ? Dans cinq cas nous pouvons déterminer d'où les *namkarum*s de nos textes recevaient leur eau :

- le *namkar* Atānum part de l'Euphrate
- le *namkar* Abu-Ṭābum part de l'Euphrate
- le *namkar* ālim part du íd Lugal/Šarrum
- le *namkar* gal ša ita ^{giš}tir part probablement de l'Irnina (*MHET* 584 et *CT* 45, 111/113)
- le *namkar* a.gàr Tenūnam part du ^{íd}Nabium-ḫegal.

[29] A 485 s.v., *atappu* restauré à partir de Adad 59 : 14. Cité aussi CAD N I s.v. *namkarum*, 231.

Dans un cas un *atappum* est dérivé d'un *namkarum* :

– l'*atap Ikūn-pī-Sin* du *namkar* xxx-a

Dans un cas un *namkarum* pourrait être issu d'un autre :

– les *namkar* Abātim du *namkar* Atānum

Cette dernière exception mise à part, les *namkarums* sont donc directement tributaires des grandes rivières comme l'Euphrate et l'Irnina ou de rivières de second ordre comme le Šarrum et le Nabium-ḫegal.

Les digues associées aux *namkarums* [30]

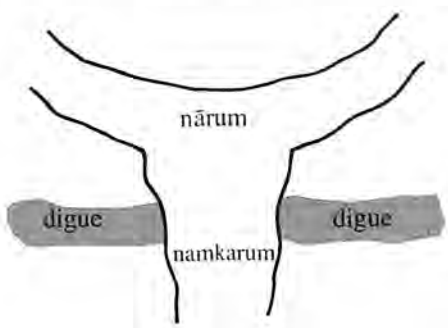
Trois *namkarums* sont attestés avec leur digue :

e *namkarim ša* dumu.meš Sin-iddinam	*MHET* 477	Ae	Iṣṣiātum
e *namkar* a.gàr	*MHET* 509	Az 6	Ḫaṣārum
e *namkar* a.gàr Tenūnam	Di 386	s.d. (Ḫa)	Tenūnam
idem	Di 686	Aṣ 4	*ibidem*

Quelques autres digues ne longent pas les *namkarums* mais se trouvent en angle droit par rapport à eux :

	en angle droit sur	date	référence
e a.gàr murub$_4$ (= Qablûm)	le *namkar ālim*	Si 9	*CT* 47, 62
e Gula et e *ša* Ikūn-pī-Sin dumu Sin-tajjār	le *namkar Atānim*	Si 14	*MHET* 426

Dans les deux cas il s'agit du schéma suivant qui est peut-être plus général que ce que le nombre fort limité des attestations laisse supposer :



[30] Il y a bon nombre de références à des digues dans le corpus sippariote. Nous reviendrons ailleurs sur ce sujet, spécialement sur les digues constituant des limites d'*ugārums*.

Dans un autre cas (Di 686, notre XV. 43) le *namkarum* est bien pourvu d'une digue à son embranchement avec le *nārum* :

Ces digues servent évidemment à protéger les terres contre les inondations de la rivière. Lorsqu'elles ne se trouvent pas immédiatement le long du cours d'eau mais à quelque distance les champs situés entre ces digues et la rivière sont appelés ú.sal/*ušallum*.

4. Du texte au champ : la formule '*kirbānam ana nārim issuk*'

Un texte que nous avons commenté plus haut dans l'*ugārum* Tenūnam, doit retenir particulièrement notre attention ici, puisqu'il précise les positions relatives d'un *nārum* et d'un *namkarum*, tout en donnant une spécification intéressante quant au *nārum*. Il s'agit d'une vente de champ, datée Si 7/12/20 (Di 680) :

Obv. 1. 0.1.5 1/2 iku [a].⌈šà⌉ a.gàr *te-nu-*⌈*nam*⌉
2. *i-ta* ^íd^*na-bi-um*-ḫé.⌈gál⌉
3. *ki-ir-ba-nam a-na* íd *is-su-*⌈*uk*⌉
4. *ù i-ta* ki.ud.meš
5. sag.bi.1.kam.ma ⌈*nam-kar*⌉ a.gàr *te-nu-*⌈*nam*⌉
6. sag.bi.2.kam.ma a.šà ⌈dumu-*iš*$_8$-*tár*⌉
7. dumu *i-šar-li-im*

Le point crucial est l'interprétation de la clause '*kirbānam ina nārim issuk*'. Après VEENHOF (1973) elle a été commentée par MALUL (1988, 406 et surtout 417) qui conclut que l'interprétation ne peut être symbolique et que c'est bien le champ qui 'jette une motte dans la rivière'.

Il est évident que cela doit indiquer une érosion des bords de la rivière. Cependant, on a objecté à cette interprétation que le verbe est au prétérit et décrit donc une action ponctuelle et unique, alors que le processus d'érosion est continu et demanderait plutôt le mode duratif du verbe.

Nous croyons que cette question peut être résolue par un raisonnement simple.

Quelle est la fonction d'une telle clause dans un contrat de vente ? Il ne peut s'agir que d'une clause qui protège le vendeur contre d'éventuelles poursuites juridiques ultérieures de l'acheteur. Le vendeur signale qu'il est déjà arrivé que le champ 'lance' une motte de terre dans la rivière et que cela pourrait donc, éventuellement, encore se produire. Il ne peut en aucun cas s'agir de prévenir l'acheteur que le champ est soumis à un processus d'érosion continu qui devrait ultimement aboutir à sa disparition complète. Le champ en question serait alors invendable.

En réalité ce genre d'érosion n'est pas continu, il peut survenir, s'arrêter puis reprendre sur des périodes assez longues. Le fait que la clause signale un événement unique par le prétérit n'infirme donc pas l'hypothèse de l'érosion.

Nous pouvons dès lors donner une représentation concrète à ce genre de situation sur le terrain. Puisqu'il y a érosion, il doit s'agir de l'endroit où celle-ci est la plus forte : la rive extérieure d'un méandre.

Le *namkarum* part donc de la rive extérieure d'un méandre, ce qui est une situation tout à fait logique : si on veut créer de grandes voies d'eau artificielles à partir des cours d'eau naturels le meilleur point de départ possible est celui où le courant pousse l'eau vers ces canaux.

Ce texte, - et les données que nous en déduisons -, rattache donc deux éléments observables sur le terrain : un méandre et le cours d'un canal important.

Nous verrons que ces données sont immédiatement observables sur les cartes et photos modernes. Une preuve encore plus convaincante nous est cependant fournie par une des rares cartes sur argile de la Mésopotamie ancienne.

Ce que la carte cassite révèle

Ce document, publié par FINKELSTEIN (1962, 80) puis republié par VAN SOLDT (1988, 104) serait cassite et proviendrait de Nippur [31]. Ce qui nous intéresse ici, c'est qu'elle reproduit exactement la situation que nous venons de décrire.

L'élément essentiel de cette carte est un grand méandre, dans lequel est inscrit le nom du cours d'eau : la rivière Ḫamri. De la partie extérieure de ce méandre partent deux canaux. A l'intérieur de ceux-ci il y a leur dénomination : '*namkarum*'.

Cela représente et confirme donc exactement la situation que nous avons dégagé de notre Di 680.

[31] Nous reviendrons ailleurs et de façon plus exhaustive sur toutes les implications hydrologiques jusqu'ici négligées de ce document fort intéressant.

Une carte ancienne et les photos satellite

Nous reproduisons ci-dessous la partie de la carte de BEWSHER (1885) (fig. 1) et d'une photo satellite [32] (fig. 2) donnant l'Euphrate entre Sippar-Jahrūrum et Sippar-Amnānum sur lequel les méandres et des canaux partant de ces méandres sont clairement perceptibles [33]. Il est clair qu'il s'agit là de structures du même type que nos *namkarums* même si leur datation est sans doute bien postérieure.

[32] Declassified Intelligence Satellite Photos, U.S. Geological Survey, U.S. Department of the Interior. Prise le 13/10/1965, n° DS1025-2120DF026. Intégrée dans le Système d'Information Géographique du P.A.I. IV/25 à l'université de Gand.

[33] Nous remercions K. Verhoeven qui a bien voulu réaliser ces reproductions.

Des canaux à double embranchement

On remarquera sur la photo (fig 2) qu'un certain nombre de *namkarums* semblent avoir des doubles embranchements à partir des rivières et qu'il y a, à partir de plus d'un méandre, des embranchements de ce type superposés.

Nous voudrions rattacher les structures de ce type au texte *CT* 47, 13/13a (Sm) que nous avons traité plus haut sous Ḫalḫalla.

Un champ y est situé entre le *namkarum labīrum*, le vieux *namkarum*, et le *namkarum eššum*, le nouveau. Sur l'enveloppe la description diffère sur un point : *labīrum* est remplacé par *šaplum*, inférieur ou en aval.

Le *namkarum* en aval, le vieux, est donc abandonné au profit d'un nouveau *namkarum* en amont. Hydrologiquement cela relève du bon sens voire de l'évidence même. Lorsqu'on abandonne l'embouchure existante, sans doute parce qu'elle ne fonctionne plus, on va prendre l'eau en amont et non en aval. Une nouvelle embouchure est donc créée. Le reste du canal reste évidemment en emploi.

Si une telle situation se reproduit quelquefois une situation d'embouchures multiples et superposées se développe, telle que nous pouvons l'observer sur les photos, dont nous tirons en exemple la fig 3.

5. Les *namkarums* par rapport à l'Irnina et l'Euphrate

Notre localisation des *ugārums* a montré que la plupart de ceux dans lesquels un *namkarum* est attesté se situent entre l'Euphrate et l'Irnina. C'est là aussi que nous avons retrouvé la plupart de nos autres cours d'eau. Dix *namkarums* se situent donc dans cette région (dont un incertain), deux seulement au nord de l'Irnina, deux se trouvent dans des *ugārums* partiellement au nord et au sud de l'Euphrate, trois dans des *ugārums* non localisés.

Il y a certainement dans les attestations de *namkarums* une partie de hasard : pour qu'ils soient mentionnés il faut qu'un champ vendu se trouve 'par hasard' à côté d'un tel canal. Cependant, sur la masse de la documentation que nous avons à présent, une telle prépondérance de la région entre l'Irnina et l'Euphrate doit quand-même être significative. La plupart des terres arables et exploitées par les Sippariotes, qu'ils soient Yahruréens ou Amnanites, doit se trouver là.

6. Le *namkarum* mesuré ?

Le seul texte qui donne réellement des mesures concernant un *namkarum* est *UET* 5, 857 transcrit et commenté par CHARPIN (1986, 76 sq). Comme le remarque l'auteur il s'agit d'un tableau calculant les dimensions d'un *namkarum* en cours de creusement. Les dimensions données sont différentes longueurs (malheureusement perdues), des largeurs et des profondeurs. La longueur totale est un peu plus de 2/3 de double-lieue, environ 7 km. Si la largeur est exprimée en coudées, elle représente environ 20 m. Cela correspond bien à l'ordre de grandeur des vestiges que nous avons relevés sur la carte. La profondeur semble pourtant très réduite : une ou deux coudées, donc un demi-mètre ou un mètre.

7. Le *namkarum* dans les autres textes

Bien que notre étude se limite à la région de Sippar pendant la période paléo-babylonienne, il nous a semblé intéressant de réunir quelques éléments provenant des périodes postérieures au sujet des *namkarum*s. Ces informations éparses montrent, à notre avis, que ce type de canal d'irrigation a non seulement continué à exister, mais qu'il a rempli les mêmes fonctions. Pendant la période paléo-babylonienne le genre de textes de notre corpus fait que nous n'avons pratiquement que des localisations dans des *ugārum*s, des relations avec d'autres cours d'eau ou des digues. La seule fonction que nous pouvons clairement dégager de ce corpus est l'irrigation.

Les textes hors de notre corpus, cités ci-dessous, permettent de dégager une autre fonction non moins importante qui est la régulation des eaux. Le fait qu'on pouvait, à Larsa, faire couler le trop plein d'eau, via un *namkarum*, dans les marais est tout à fait claire à ce sujet. La mention d'un *natbaktu* et surtout d'un *balīṭum*, ce dernier non seulement sur la carte cassite mais aussi dans notre corpus, comme une sorte de réservoir, est un autre élément de ce système régulatoire. Nous reviendrons sur ce sujet dans une autre publication.

L'étude de VAN SOLDT dans le *BSA* (1988), concernant les attestations cassites du *namkarum* a livré, en résumé, les points suivants :

- le *namkarum* part d'un cours d'eau important ;
- c'est une structure creusée (*ḫerû*) par l'homme ;
- il pouvait être ouvert et fermé selon les besoins de l'irrigation bien qu'il est probable qu'il ne servait pas directement à l'irrigation mais qu'il était utilisé pour remplir un *natbaktu* ;
- il pouvait être assez long et irriguer différents champs, voire même un *tamirtu* entier.

Enfin, des références reprises dans le *CAD* s.v. et tirées de textes en dehors de notre corpus on peut encore dégager les caractéristiques suivantes :

– le caractère artificiel du *namkarum* :

ana namkarim ḫerêm qātam aštakan	je viens de commencer à creuser un namkarum (*TIM* 2, 4 : 5 = *AbB* 8, 4).

– le *namkarum* est un moyen d'irriguer les champs :

un champ incultivable qui n'a ni *atappum*, ni *namkarum*, ni digue (*kalû*) (Kudurru, MB, *MDP* 10 pl. 11 i 5).

– le *namkarum* pouvait servir de régulateur en cas de forte crue :

mû mādu namkarī ša ana appārim šaknu puttīma appāram ša itāt Larsa mê mulli	il y a beaucoup d'eau, ouvrez les *namkarums* qui donnent sur le marais et remplis le marais autour de Larsa (*OECT* 3, 7 : 6 = *AbB* 4, 85).
šumma nāru gapšatma mûša ana namgarāti la īrubu	si une rivière est 'gonflée' mais que son eau n'entre pas dans les *namkarums* (il y aura une inondation qui ne pourra être contenue) (Alu, SB, *CT* 39, 19, 125).

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CANAUX PALEO-BABYLONIENS : LE DOSSIER DU CANAL ŪBIL-NUHŠAM DANS LA PROVINCE DU YAHRURUM INFERIEUR *

par Denis LACAMBRE **

Comme on le sait, le développement de l'agriculture en Mésopotamie reposait sur un système d'irrigation complexe, qui comprenait un important réseau de canaux. A la période paléo-babylonienne, un canal appelé Ūbil-nuhšam ("Il a apporté l'abondance") nous est connu à l'époque du roi de Babylone Samsu-iluna (1749-1712 av. J.-C.) [1].

Ce cours d'eau est mentionné dans le dossier de la gestion des palmeraies royales de la province du Yahrurum inférieur (Yahrurum šaplûm), réuni par D. Charpin et M. Stol [2]. Malheureusement, ces documents sont issus de fouilles clandestines et on n'en connaît plus l'origine précise [3].

Les attestations relatives à ce canal ont été réunies progressivement. Elles ont d'abord été signalées dans l'étude de D. Cocquerillat sur les palmeraies à l'époque paléo-babylonienne [4], puis dans le *RGTC* 3 [5]. En 1981, D. Charpin et J.-M. Durand, à

* Je voudrais remercier G. Colbow pour m'avoir permis d'obtenir une copie de l'article GRANT 1938. Je suis reconnaissant à D. Charpin de l'aide qu'il m'a apportée dans la résolution de difficultés que j'ai rencontrées à la lecture de certains textes, à M. Stol pour m'avoir envoyé des références complémentaires et à J. Goodnick Westenholz (Chicago) et à W. Hallo (Yale) pour m'avoir autorisé à utiliser le résultat de leurs collations. Enfin, je voudrais remercier Ö. Tunca pour son aide et ses conseils tout au long de l'élaboration de cet article.

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1 Selon la chronologie dite "moyenne". Pour de nouvelles propositions concernant la chronologie absolue et l'établissement d'une chronologie "courte", où le règne de Samsu-iluna est daté de 1653-1616 av. J.-C., cf. GASCHE *et al.* 1998 (en particulier p. 91).

2 Cf. CHARPIN 1981, 519-529 (archives A et B) ; STOL 1982, 162-163.

3 Cf. CHARPIN 1981, 519, 528 ; CHARPIN 1992, 214.

4 Cf. COCQUERILLAT 1967, 173-175 et 186-187.

5 Cf. *RGTC* 3, 313, s.v. Ūbil-nuḫšam.

Changing Watercourses in Babylonia.
Towards a Reconstruction of the Ancient
Environment in Lower Mesopotamia I
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l'occasion de la publication de textes du Louvre, avaient rassemblé l'ensemble des références [6], à l'exception de trois attestations supplémentaires issues de *YOS* 12 [7]. On note la dispersion dans les collections du monde entier de tablettes qui appartiennent au même dossier. Les documents se trouvent aussi bien à Chicago [8], au Louvre [9], à Yale [10], que dans des collections privées [11].

Au total, on dispose d'onze attestations du canal Ūbil-nuhšam situé dans la province du Yahrurum inférieur. A ces tablettes qui mentionnent expressément le nom du canal, on peut ajouter d'autres références qui se rattachent aux mêmes dossiers.

On notera, en outre, que l'usage du nom de ce canal n'était pas limité à la Babylonie, puisqu'on le retrouve aussi dans deux documents du royaume d'Ešnunna.

On présentera dans un premier temps le détail de l'ensemble des attestations et l'analyse du nom de ce canal, puis on abordera le problème de sa localisation, et enfin on donnera l'ensemble des indications topographiques que l'on a pu réunir.

1. LES ATTESTATIONS DU CANAL ŪBIL-NUHŠAM

1.1. *Le canal Ūbil-nuhšam dans la province du Yahrurum inférieur*

Les onze attestations connues du canal Ūbil-nuhšam, sont toutes datées du roi Samsu-iluna, entre la 2^{e} année de son règne (*BIN* 2 77, du 20/ix/Si 2) et la 28^{e} année de son règne (LANGDON 1930, 83, du 5/iii/Si 28).

On peut noter qu'on ne trouve pas moins de dix graphies différentes qui sont réunies ci-dessous :

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6 Cf. CHARPIN et DURAND 1981, 27-29 : AO 10333 : 2 (F) ; *BIN* 2 77 : 5 (A) ; *BIN* 7 182 : 6 (D) ; GRANT 1938, 242, no 9 : 5 (G) ; LANGDON 1930, 83 : 2 ; LANGDON 1934, 557 : 3 (C) ; *YOS* 12 434 : 6 (H), auxquelles on rajoutera GRANT 1938, 232, no 4 : 2 (cf. *RGTC* 3, 313).

7 *YOS* 12 298 : 2 ; *YOS* 12 440 : 1 ; *YOS* 12 516 : 2.

8 Les tablettes éditées dans GRANT 1938 se trouvent désormais à l'Institut Oriental de l'Université de Chicago (où une nouvelle numérotation en A. leur a été donnée), d'après STOL 1976, 55 et n. 1. Ainsi, on a désormais GRANT 1938, 232, no 4 = A.32138 et GRANT 1938, 242, no 9 = A.32144.

9 Il s'agit de AO 10333, cf. NOUGAYROL 1979, 73 (copie) et CHARPIN et DURAND 1981, 27-29 (trs. et trd.).

10 Il s'agit des références issues des volumes *BIN* 2, *BIN* 7 et *YOS* 12. Voir aussi BECKMAN 1995, 2, n. 10 qui rappelle que des textes inédits, qui viennent compléter les dossiers établis dans CHARPIN 1981, se trouvent encore à Yale.

11 Il s'agit des deux tablettes éditées dans LANGDON 1930, 83-84 et LANGDON 1934, 556-559.

Graphie	*Graphie complète*	*Référence*	*Date*
Ūbil-nuhša(m)	pa$_5$-*ú-bi-il-nu-uh-ša-am*	*BIN* 2 77 : 5	20/ix/Si 2
	pa$_5$-*ú-bi-il-nu-uh-ša*	*BIN* 7 182 : 6	24/xii/Si 4
	i$_7$-*ú-bi-il-nu-úh-ša*	AO 10333 : 2	-/iv/Si 5
	i$_7$-*ú-b*[*í*]*-il-nu-uh-ša*	*YOS* 12 440 : 1	30/xii/Si 23
	ú-bil*(NE)**-nu*-uh*-ša** [12]	*YOS* 12 516 : 2	4/iii/Si 28
Ūbin-nuhša(m)	gú i$_7$-*ú-bi-in-nu-uh*-*[*ša*] [13]	*YOS* 12 298 : 2	[...]/iv/Si 8
	gú i$_7$-*ú-bi-in-nu-<uh>-ša-am* [14]	GRANT 1938, 232, no 4 : 2	2/v/Si 8
Ūbil-nuhši(m)	gú i$_7$-*ú-bi-il-nu-uh*$^!$*-ši-im*	LANGDON 1930, 83 : 2	5/iii/Si 28 [15]
TIBI-nuhši	gú i$_7$-⌜*ti-bi*⌝*-nu-<uh>-ši* [16]	*YOS* 12 434 : 6	15[+x?]/x/Si 23
	gú i$_7$-*ti*-bi-nu-uh-ši** [17]	GRANT 1938, 242, no 9 : 5	18/x/Si 23
Nuhši	*a-ah* i$_7$-*nu-uh-ši*	LANGDON 1934, 557 : 3	10/xii/Si 3

1.2. Les différents dossiers

Les textes qui mentionnent le canal Ūbil-nuhšam ont été regroupés en quatre grands dossiers, qui ne sont pas sans liens entre eux.

1.2.1. Warad-Tišpak, propriétaire et témoin (Si 6-Si 8)

Le texte *YOS* 12 174 (15/iii/Si 6) est un contrat de location d'un champ voisin de celui de Warad-Tišpak, qui était lui-même situé près du canal Ūbil-nuhšam, d'après

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12 La ligne a été collationnée le 01/03/99 par W. Hallo.

13 Variante signalée dans CHARPIN 1981, 544. Le signe ŠA n'est pas présent sur la tablette d'après la collation de la ligne effectuée par W. Hallo le 01/03/99.

14 La ligne a été collationnée le 29/01/99 par J. Goodnick Westenholz que je cite ici : "There is no UH sign on line 2 of A.32138 nor is there any room for it. The line wraps around the tablet with ŠA-AM on the right edge."

15 La date de ce texte a été donnée dans CHARPIN et DURAND 1981, 28.

16 Cette lecture est donnée en fonction de la copie de la ligne que m'a fait parvenir W. Hallo le 01/03/99. D'après lui, il est possible que le premier signe soit un TI, ce qui coïnciderait avec le duplicat de ce texte (GRANT 1938, 242, no 9 : 5 ; cf. *YOS* 12, 17). La lecture proposée par CHARPIN et DURAND 1981, 28 (H : gú i$_7$-*na*$^!$*-qá-a*[*b*]*-nu-<uh>-ši*, qui est la même que celle de l'index de *YOS* 12, 71), ne semble plus devoir être retenue.

17 La ligne a été collationnée le 29/01/99 par J. Goodnick Westenholz que je cite ici : "The signs of A.32144 (...) reflect the copy and there is no question that it is a TI sign and not an Ú. This line (...) wraps around the tablet over the right edge and on to the reverse of the tablet. The TI sign is the first sign on the right edge and ŠI is on the reverse." Cela confirme les lectures proposées antérieurement, cf. *RGTC* 3, 313 (^{i_7}*ti-bi-nu-uḫ-ši*$^!$) ; CHARPIN et DURAND 1981, 28 (G : gú ^{i_7}*ti*$^?$*-bi*$^?$*-nu-uh-ši*) et semble se retrouver dans le duplicat de ce texte (*YOS* 12 434 : 6 ; cf. *YOS* 12, 17).

YOS 12 298 ([...]/iv/Si 8). On peut noter que le même formulaire se trouve dans les deux textes [18].

On retrouve Warad-Tišpak comme témoin dans GRANT 1938, 232, no 4 : 14 (2/v/Si 8), à propos de la location d'un terrain situé sur le canal Ūbil-nuhšam. De même, un autre témoin qui apparaît dans ce texte, le scribe Zikir-ilišu (l. 15-16), est présent dans *YOS* 12 174 : sceau *a* [19] et dans *YOS* 12 298 : 13-14.

1.2.2. Locations de champs par Warad-Šurinni (Si 20-Si 23)

Warad-Šurinni est mentionné dans un texte de location de champs, d'après *YOS* 12 398 : 5 (16/ii/Si 20) et dans un texte de location d'un verger, d'après *YOS* 12 440 : 5 (30/xii/Si 23).

1.2.3. Locations de champs près du canal Ūbil-nuhšam en Si 28

On a réuni dans ce dossier deux contrats de locations de champs inondables (a-šà ú-sal), *YOS* 12 516 (4/iii/Si 28) et LANGDON 1930, 83 (5/iii/Si 28).

1.2.4. Le dossier des Rababéens (Si 2-Si 5, Si 7-Si 8, Si 23 et Si 26)

Un quatrième dossier plus important est celui de la location du (ou des) vergers et de champs de membres de la tribu des Rababéens près du canal Ūbil-nuhšam, dans le cadre d'attributions de terre pour la mise en culture de palmeraies. Ce dossier est connu depuis longtemps, à travers les travaux de B. Landsberger [20], de D. Cocquerillat [21] et de M. Heltzer [22]. D. Charpin et M. Stol ont donné l'essentiel de la bibliographie dans leur compte rendu de *YOS* 12 [23], qui est à compléter par l'étude de D. Charpin et J.-M. Durand [24], qui comprend deux nouveaux textes du Louvre.

Dans l'ordre chronologique, on peut réunir les références suivantes :

Si 2 à Si 5 : *BIN* 2 77 : 1-6 (20/ix/Si 2) ; AO 10340 : 1-3 (1/xii/Si 2) ; LANGDON 1934, 557 : 1-3 (10/xii/Si 3) ; *BIN* 7 182 : 1-7 (24/xii/Si 4) ; *YOS* 12 126 : 1-5 (5/i/Si 5) ; AO 10333 : 1-5 (-/iv/Si 5).

Si 23 : *YOS* 12 434 : 1-6 (15[+x?]/x/Si 23) ; GRANT 1938, 242, no 9 : 1-5 (18/x/Si 23).

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18 Cf. CHARPIN 1981, 546.

19 Cf. CHARPIN 1981, 546.

20 Cf. LANDSBERGER 1967, 57.

21 Cf. COCQUERILLAT 1967, 173-176 et 186-187.

22 Cf. HELTZER 1978, 5-6 et 12-13.

23 Cf. CHARPIN 1981, 521 (archives A 8) ; STOL 1982, 162, n. 3.

24 Cf. CHARPIN et DURAND 1981, 27-29.

A ces documents qui mentionnent directement le verger des Rababéens, on peut adjoindre les textes suivants qui appartiennent au même dossier et qui datent des années Si 5-Si 8 et Si 26 : *YOS* 12 135 (20/iv/Si 5) et *YOS* 12 217 (-/iii/Si 7), d'après CHARPIN 1981, 521 (archives A 8) ; *TLB* 1 205 (1/v/Si 8), *TIM* 5 40 ([...]/iii/Si 26), UNGNAD 1925, 95 : *BJ* 91 (sans date), d'après STOL 1982, 162, n. 3.

1.3. Le canal Ūbil-nuhšam dans le royaume d'Ešnunna

Le nom de ce canal était assez répandu, puisqu'on a deux attestations qui se trouvent dans la documentation du royaume d'Ešnunna. Il s'agit tout d'abord d'un contrat (MUHAMED 1992, no 9 : 2) découvert dans une maison de l'ancienne Mê-Turran (actuellement Tell Haddad-Tell es-Sib), dans la région du Hamrin [25]. L'autre référence est une lettre ayant trait à l'irrigation (DEJONG ELLIS 1972, 67, no 68 [26]) et retrouvée à Tell Harmal, l'ancienne Šaduppum.

Graphie	*Graphie complète*	*Référence*	*Date*
Ibin-nuhši	pa$_5$-*i-bi-in-nu-uh-ši*	MUHAMED 1992, no 9 : 2 [27]	(Narām-Sîn [28])
TIBIN-nuhši	*ti-bi-in-nu-*⌈*uh-ši*⌉	DEJONG ELLIS 1972, 67, no 68 : 12	—

Ces deux références ne seront pas retenues dans notre étude, du fait de leur provenance (royaume d'Ešnunna) ou de leur datation (MUHAMED 1992, no 9).

2. LE NOM DU CANAL

2.1. *Sens et graphies*

Le nom du canal doit sans doute se comprendre comme : "Il a apporté l'abondance". Il faut supposer que le sujet sous-entendu est un des rois de Babylone. Dans l'histoire mésopotamienne, on trouve de multiples noms d'années qui commémorent les travaux d'irrigation entrepris par les souverains. On connaît d'ailleurs plusieurs mentions de canaux portant un nom similaire à celui étudié ici-même dans les noms d'années des souverains de la I^re^ dynastie de Babylone [29]. D'autre part,

[25] Cf. CHARPIN 1997-1998, 346a (*sub* "no 9"). Je remercie D. Charpin de m'avoir signalé cette référence.

[26] Référence communiquée par M. Stol. Il s'agit de la lettre IM 52443, envoyée par Nawram-šarūr à Nanna-mansum.

[27] Cf. MUHAMED 1992, 41-42 (trs. et trd.), Pl. 13-14 (copies) et Pl. 45 (photos).

[28] On trouve un serment juré par Tišpak et par Narām-Sîn aux l. 13-14.

[29] Cf. PIENTKA 1998, 224. Pour la réunion des noms de canaux de la période paléo-babylonienne attestés dans les noms d'années jusqu'au règne de Hammu-rabi de Babylone, cf. EDZARD 1957, 112-117.

l'abondance qu'apporte et que fait régner le monarque parmi ses sujets est un thème classique de l'idéologie royale [30].

Parmi les onze attestations que l'on a réunies, on note une grande diversité dans les graphies. Ainsi, la marque de la mimation après *nuhšum* n'est présente que dans quatre attestations (*BIN* 2 77 : 5 ; GRANT 1938, 232, no 4 : 2 ; LANGDON 1930, 83 : 2 et peut-être *YOS* 12 298 : 2). Ensuite, on remarque que l'emploi des signes diffèrent dans plusieurs cas : on a le signe BÍ (*YOS* 12 440 : 1) à la place de BI, le signe ÚH (AO 10333 : 2) à la place de UH, et le signe BIL à la place de BI-IL (*YOS* 12 516 : 2).

L'oubli de signes est aussi à signaler : le signe UH a été omis dans deux attestations (GRANT 1938, 232, no 4 : 2 ; *YOS* 12 434 : 6) ; le signe IL est peut-être manquant dans GRANT 1938, 242, no 9 : 5 ; la forme verbale n'a pas été inscrite dans LANGDON 1934, 557 : 3.

On note encore l'assimilation du *-l* de la forme verbale au *n-* qui suit, phénomène qui est attesté avec certitude dans deux de nos références (GRANT 1938, 232, no 4 : 2 ; *YOS* 12 298 : 2) [31].

La variante TIBI-nuhši, présente dans deux de nos attestations (GRANT 1938, 242, no 9 : 5 ; *YOS* 12 434 : 6), rappelle la formulation que l'on trouve dans les listes lexicales : *tu-bil nu-uh-šú* ou *tu-bil nu-uh-šá* [32].

Enfin, il faut évoquer la proposition de D. Charpin et J.-M. Durand [33] de voir dans la désignation i_7-nin-hé-gál qui se trouve dans AO 10340 : 3 (1/xii/Si 2), une variante du nom de notre canal. Ce texte appartient aux dossiers des Rababéens, où le canal Ūbil-nuhšam est abondamment mentionné. Cependant, si on peut trouver l'équivalence dans les listes lexicales entre le sumérien hé-gál et l'akkadien *nuhšum* [34], il ne semble pas possible de trouver ici une traduction sumérienne du nom akkadien de ce canal. La proposition d'en faire une autre désignation du canal Ūbil-nuhšam ne sera donc pas retenue. On a supposé qu'il s'agissait d'un autre cours d'eau situé à proximité.

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30 Cf. RENGER 1990, 34, § 1.4.1.

31 Pour un phénomène comparable, voir aussi les attestations de Mê-Turran (MUHAMED 1992, no 9 : 2) et de Šaduppum (DEJONG ELLIS 1972, 67, no 68 : 12).

32 Cf. *MSL* 11, 26, l. 24' : i_7-làl-ab-uš = *tu-bil nu-uh-šú* et *ibid.*, 40, l. 14 : i_7-làl-ab-uš = *tu-bil nu-uh-šá* (références que je dois à M. Stol). Voir aussi *AHw*, 1451a (s.v. *w/babālu(m)* II.1b) ; *CAD* N/2, 319a (s.v. *nuḫšu*). On remarquera qu'une graphie analogue se trouve dans l'exemple de Tell Harmal (DEJONG ELLIS 1972, 67, no 68 : 12).

33 Cf. CHARPIN et DURAND 1981, 28.

34 Cf. par exemple *CAD* Ḫ, 167 (s.v. *ḫegallu*) et *ibid.*, 168a pour les différents noms de canaux qui contiennent hé-gál dans leur nom.

2.2. *Indication du type de canal*

Dans huit attestations sur onze, devant le nom de ce canal on trouve le déterminatif i_7 (*nārum* en akkadien), ce qui est la marque d'un canal de grande taille. Ce déterminatif est présent dans les textes à partir du 10/xii/Si 3 (LANGDON 1934, 557 : 3), jusqu'au 5/iii/Si 28 (LANGDON 1930, 83 : 2).

Dans deux cas, on trouve le déterminatif pa_5 (*palgum*) avec *BIN* 2 77 : 5 (20/ix/Si 2) et *BIN* 7 182 : 6 (24/xii/Si 4). Ce terme a été récemment traduit par "fossé d'irrigation" [35]. Il s'agit en tout cas d'un canal de moindre importance. On peut noter qu'il s'agit de deux attestations datées des débuts de notre corpus et on peut se demander, à titre d'hypothèse, si le canal n'a pas été élargi par la suite.

Seule la référence *YOS* 12 516 : 2 (4/iii/Si 28) ne comporte aucun déterminatif.

L'analyse de l'ensemble de ces attestations semble indiquer que l'on se trouve en présence d'un canal de grande taille.

3. UN CANAL DE LA PROVINCE DU YAHRURUM INFERIEUR

3.1. *La province du Yahrurum inférieur*

La province du Yahrurum inférieur a été située dans un triangle délimité par les villes de Kiš, Marad et Dilbat par W.F. Leemans [36]. Cette localisation a été reprise dans les études de D. Charpin [37] et de M. Stol [38].

Cette proposition repose notamment sur l'étude de *SVJAD* 137 [39] qui dresse l'inventaire des vergers de cette région sous la responsabilté du chef-jardinier (*sandanakkum*) Mār-Babilim [40]. Ce document constitue la base des renseignements géographiques dont nous disposons sur la région du Yahrurum inférieur. Malheureusement, le canal qui fait l'objet de notre étude n'apparaît pas dans la partie conservée de la tablette.

Les éléments qui ont permis de situer ce cours d'eau dans la province du Yahrurum inférieur reposent d'abord sur les regroupements archivistiques effectués par D. Charpin, qui montrent que tous les textes qui mentionnent ce canal appartiennent à la gestions des palmeraies de la province du Yahrurum inférieur [41].

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35 Cf. CIVIL 1994, 109 et 111 ("irrigation ditch").

36 Cf. LEEMANS 1958, 140, n. 1.

37 Cf. CHARPIN 1981, 527-528 et n. 8 ; CHARPIN 1992, 214.

38 Cf. STOL 1982, 162, n. 4.

39 Cf. RIFTIN 1937, Pl. 85-86, no 137.

40 Cf. LEEMANS 1958, 140, n. 1 ; CHARPIN 1981, 522-523, 527 ; STOL 1982, 162, n. 4.

41 Cf. CHARPIN 1981, 519-529 (archives A et B).

Un autre indice nous est donné par la proximité entre le canal Ūbil-nuhšam et le canal Amatum qui apparaît dans un des textes de notre dossier (*BIN* 7 182 : 6-7). Or, on sait que le canal Amatum était proche de la ville de BaDrum [42], située dans cette province [43]. Le canal Ūbil-nuhšam était donc un des multiples canaux qui irriguaient la province du Yahrurum inférieur.

3.2. *Une mention dans un nom d'année de Samsu-iluna ?*

On a noté que toutes les attestations que l'on peut rattacher à la province du Yahrurum inférieur, datent du règne du roi de Babylone Samsu-iluna. On peut alors se demander si le nom de ce canal ne renvoie pas à de grands travaux que le souverain aurait engagés dans cette région, proche de la capitale Babylone, et qu'il aurait ensuite commémorés dans un de ses noms d'années [44].

Dans un premier temps, on avait pensé faire le lien entre une variante du nom du canal qui se serait trouvée sur le texte *YOS* 12 434 : 6 (d'après la lecture proposée dans l'index de *YOS* 12 : "ÍD *Na-qá-ab-nu-<uḫ>-ši*" [45]) et le nom de la 3^{e} année de règne de Samsu-iluna qui mentionnait un canal nommé Samsu-iluna-nagab-nuhši ("Samsu-iluna-est-la-Source-de-la-Prospérité") [46]. On retrouve ce canal mentionné dans le nom de sa 26^{e} année [47]. Ce rapprochement aurait été d'autant plus intéressant que par une variante du nom de l'année 11 d'Ammiṣaduqa (1635 av. J.-C.), on apprend que ce canal se trouvait près de l'Euphrate : "Année où Ammiṣaduqa a construit Dūr-Ammiṣaduqa sur la rive du canal Samsu-iluna-nagab-nuhši, à l'embouchure de l'Euphrate" [48].

Cependant, on a vu plus haut que la lecture de *YOS* 12 434 doit être corrigée d'après la collation de la ligne 6, la lecture proposée du duplicat de ce texte (GRANT 1938, 242, no 9 : 5) et l'ensemble des attestations qui ont été réunies plus haut.

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42 Cf. CHARPIN 1981, 525, 528.

43 Cf. CHARPIN 1981, 527 et n. 8. On trouve mention de cette ville dans *SVJAD* 137, col. i 10, 17-19, (cf. *RGTC* 3, 35).

44 Pour la I^{re} dynastie de Babylone, cf. PIENTKA 1998, 224-225.

45 Cf. *YOS* 12, 71. Cette lecture a été suivie dans CHARPIN et DURAND 1981, 28.

46 Cf. UNGNAD 1938, 182 (*sub* no 148) ; *CAD* N/1, 110b (s.v. *nagbu* A.2d) ; *CAD* N/2, 319b (s.v. *nuḫšu*) ; *RGTC* 3, 306 (s.v. Samsuiluna-nagab-nuḫuš-nišī) ; HORSNELL 1984, 29-30. Pour les noms d'années en général, on peut se reporter à la base de données réunie par M. Sigrist et P. Damerow que l'on trouve sur le site internet de l'Institut Max-Planck à Berlin (http ://www.mpiwg-berlin.mpg.de/Yearnames/yn-index.htm).

47 Cf. UNGNAD 1938, 184 (*sub* no 171) ; *CAD* N/1, 110b (s.v. *nagbu* A.2d). On trouve aussi une mention d'un canal appelé Samsu-iluna-hegal ("Samsu-iluna-[est *ou :* apporte]-l'Abondance"), dans le nom de la 4^{e} année du roi Samsu-iluna, cf. UNGNAD 1938, 182 (*sub* no 149) ; *RGTC* 3, 306 (s.v. Samsuiluna-ḫegal) ; HORSNELL 1984, 30.

48 Cf. *VS* 22 17 : (2') [mu *am-mi-ṣa-d*]*u-qá* lugal-e (3') [bàd-*am-mi-ṣa*]*-du-qá*$^{\mathrm{ki}}$ (4') [gú i_7-*sa-am-s*]*u-i-lu-na-nagab*(IDIM)*-nu-úh-ši* (5') [ka i_7-buranun]$^{\ulcorner \mathrm{ki} \urcorner}$ bí-in-dù-a, cité dans PIENTKA 1998, 109. Les restitutions se basent sur l'ensemble des attestations réunies par l'auteur.

Il n'est donc pas possible d'établir un lien certain entre un nom d'année de Samsu-iluna et le canal qui fait l'objet de notre étude. On perd une précieuse indication géographique, en attendant la publication de nouvelles données.

3.3. *Les cours d'eaux proches du canal Ūbil-nuhšam*

Si on ne peut rattacher le canal étudié à un lieu géographique précis, on peut par contre préciser la composition du réseau de canaux qui se trouvait alentour. A côté du canal Ūbil-nuhšam, se trouvaient deux grands canaux appelés Amatum et Ninhegal, ainsi qu'un petit canal-*atappum* Gimullum. Notons également qu'on mentionne une digue dans un de nos textes.

3.3.1. Le canal Amatum

Un renseignement intéressant nous est donné par *BIN* 7 182 : 6-7 (24/xii/Si 4). On voit en effet qu'un verger était situé le long du canal Ūbil-nuhšam et le long du canal Amatum [49]. Or, on sait que le canal Amatum était un autre cours d'eau important de la région du Yahrurum inférieur, passant à proximité de la ville de BaDrum [50]. On dispose en effet de tout un dossier, réuni par D. Charpin, qui rapporte la réquisition de travailleurs originaires du royaume du Malgium [51], pour effectuer la moisson et le ramassage de la paille sur le champ-*biltum* de Marduk-mušallim [52], situé le long de ce canal.

3.3.2. Le canal Ninhegal

Le canal Ninhegal est mentionné dans le texte AO 10340 : 3 [53] (1/xii/Si 2) qui fait partie du dossier des Rababéens. On a vu plus haut qu'il fallait distinguer ce cours d'eau du canal Ūbil-nuhšam, bien qu'il soit proche lui aussi du verger des Rababéens.

3.3.3. Le canal Gimillum

Parmi les différents cours d'eau situés à proximité du canal Ūbil-nuhšam, on trouve dans LANGDON 1934, 557 : 2 (10/xii/Si 3), la mention d'un canal-*atappum* appelé Gimillum [54].

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49 D'après une restitution de *BIN* 7 182 : 7 proposée dans CHARPIN 1981, 528, n. 11. On a donc : (1) 1 (búr) 1 (ešè) gán ^{giš}kiri$_6$ (...) (6) sag-ki an-ta pa$_5$-*ú-bi-il-nu-uh-ša* (7) *ù* sag-ki ki-ta i$_7$-*<a>-ma-tim*.

50 Cf. CHARPIN 1981, 525, 528.

51 Cf. CHARPIN 1981, 525 ss (archives B 8), 528 et plus récemment CHARPIN 1992, 218, n. 75.

52 Cf. CHARPIN 1981, 523-524 (tableau) et 525 ss.

53 AO 10340 : (1) ^{giš}kiri$_6$ lú-meš *ra-ba-ba-i*^{ki} (2) *ru-ús* šu-HA (3) gú i$_7$-nin-hé-gál.

54 LANGDON 1934, 557 : (1) 2 (ešè) gán ^{giš}kiri$_6$ *ru-ús* šu$^!$-HA$^!$ (2) ús-sa-du *a-tap-pu-um gi-mil-lum* (3) *a-ah* i$_7$-*nu-uh-ši*. Pour la lecture de la l. 1, cf. CHARPIN et DURAND 1981, 28.

Un canal désigné sous le nom de *atappum* était un canal secondaire [55] qui devait aboutir à un cours d'eau de plus grande importance, ici sans doute le canal Ūbil-nuhšam (mentionné dans LANGDON 1934, 557 : 3). Ceci montre bien le rôle majeur de notre canal dans le système d'irrigation de la région du Yahrurum inférieur.

La dénomination de ce canal secondaire a pu être faite en fonction d'un particulier, appelé Gimillum, qui pourrait être le propriétaire d'un champ qui se trouvait à proximité de ce cours d'eau.

3.3.4. Digue/levée de terre (e)

Une levée de terre (e) [56], qui devait se trouver le long d'un canal, est mentionnée dans *YOS* 12 217 : 2 [57] (-/iii/Si 7). Ce texte a été rattaché au dossier des Rababéens.

4. LES AUTRES INDICATIONS DE LOCALISATIONS

Un certain nombre d'indications de localisations apparaissent dans les textes citant le canal Ūbil-nuhšam et dans les dossiers qui s'y rattachent. On en a dressé la liste ci-dessous.

4.1. *Les voisins directs du canal*

Les possessions des individus ou des groupes qui ont été rassemblées dans cette partie sont toutes situées expressément sur la rive du canal Ūbil-nuhšam.

Adad-kûm-anāku : son terrain est voisin d'un champ (a-šà) loué sur la rive du canal Ūbil-nuhšam dans AO 10333 : 3 (-/iv/Si 5).

Id[din-Šama]š : il possédait un champ-*biltum* (a-šà gú-un) d'après GRANT 1938, 232, no 4 : 1 (2/v/Si 8).

Individus du Malgium (erín-meš lú-sig$_4$^{ki}) : un verger (^{giš}kiri$_6$) leur appartenant est mentionné dans *BIN* 7 182 : 4 (24/xii/Si 4) [58].

Nabium-mālik : il apparaît dans les textes qui appartiennent au dossier des Rababéens. On mentionne son champ dans *BIN* 2 77 : 6 (20/ix/Si 2), AO 10333 : 4 (-/iv/Si 5) et *YOS* 12 135 : 1-3 (20/iv/Si 5).

Nidnat-Sîn : il possédait un verger d'après *YOS* 12 440 : 1-4 (30/xii/Si 23).

Rababéens : ils possédaient un ou des vergers d'après : *BIN* 2 77 : 1-6 (20/ix/Si 2) ; LANGDON 1934, 557 : 1-3 (10/xii/Si 3) ; *BIN* 7 182 : 1-7 (24/xii/Si 4) ; *YOS* 12

55 Cf. *CAD* A/2, 484a, s.v. *atappu* 1. : "a small branch of a canal" ; *AHw*, 86b, s.v. *atappu(m)* : "(kleiner) Kanal" ; STOL 1976-1980, 356 ; RENGER 1990, 32, § 1.3.1.

56 Cf. STOL 1976-1980, 356-357 ; CIVIL 1994, 109.

57 *YOS* 12 217 : (1) a-šà *hu-up-tum* (2) ús-sa-du *ni-si-ih-ti* e. Pour la lecture et l'interprétation de ce passage, cf. *CAD* N/2, p. 269b, s.v. nisiḫtu 1.

58 Cf. CHARPIN 1981, 528.

434 : 1-6 (15[+x$^{?}$]/x/Si 23) ; GRANT 1938, 242, no 9 : 1-5 (18/x/Si 23). Un champ leur appartenant est mentionné dans AO 10333 : 1-5 (-/iv/Si 5).

Simtī-Kaspum [59] : un champ inondable (a-šà ú-sal) lui appartenant est loué dans LANGDON 1930, 83 : 1-3 (5/iii/Si 28).

Soldats du roi (erín-meš ka-kéš lugal) : ils occupaient un verger voisin de celui des Rababéens, d'après *BIN* 2 77 : 4 (20/ix/Si 2) et *BIN* 7 182 : 5 (24/xii/Si 4).

Warad-Tišpak [60] : il possèdait un champ situé près du canal Ūbil-nuhšam, d'après *YOS* 12 298 : 1-3 ([...]/iv/Si 8), et à proximité de celui Ibni-Adad, d'après *YOS* 12 174 : 1-2 (15/iii/Si 6).

... ?... : on lui louait des terres inondables (a-šà ú-sal-meš), d'après *YOS* 12 516 : 1-4 (4/iii/Si 28).

4.2. *Les voisins proches*

Les personnes suivantes sont mentionnées ici car, même si leurs champs ou leurs vergers ne sont pas situés près du canal Ūbil-nuhšam, on peut rattacher ces textes aux dossiers mentionnés ci-dessus et en déduire que leurs terres n'étaient pas très éloignées de ce cours d'eau.

Abum-waqar : on trouve la mention d'un champ lui appartenant, dans *YOS* 12 398 : 1-4 (16/ii/Si 20). Un des deux preneurs du champ était Warad-Šurinni qui louait un champ près du canal Ūbil-nuhšam, d'après *YOS* 12 440 : 5 (30/xii/Si 23).

École (é-dub-ba) : un champ de l'école (a-šà é-dub-ba), voisin du verger des Rababéens, est mentionné dans *YOS* 12 126 : 3 (5/i/Si 5).

Ibni-Adad : le champ qu'il possède d'après *YOS* 12 174 : 1-4 (15/iii/Si 6) devait se trouver à proximité du canal, puisqu'il était voisin de Warad-Tišpak.

Fils d'Ilī-Kimtī : ils possédaient un verger à proximité du verger des Rababéens, d'après *YOS* 12 126 : 2 (5/i/Si 5).

Issu-arik : d'après *YOS* 12 135 : 1-3 (20/iv/Si 5), son champ était proche de celui de Nabium-mālik.

Kaspuša et les jardiniers [61] : on leur loue un champ, d'après *TIM* 5 40 : 1-3 ([...]/iii/Si 26), texte qui a été rattaché au dossier des Rababéens.

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59 On proposera la lecture suivante : *si-im-ti*-kù$^{!}$-babbar$^{!}$-*um*$^{!}$ (l. 3 et 4) *contra* LANGDON 1930, 84 : 3-4, "*Si-im-ti-ḫa-ru-du*(?)".

60 Pour la lecture de ce nom propre, cf. CHARPIN 1981, 545.

61 *TIM* 5 40 : (2) (...) *kas*$_{6}$(KUM)*-pu-ša* (3) ⸢*ù*⸣ nu ^{giš}kiri$_{6}$-meš *tap-pé-e-šu*. On connaît un chef-jardinier (*sandanakkum*) de ce nom, d'après *YOS* 12 401 : 20 du -/-/Si 21 (cf. CHARPIN 1981, 544), qui appartient aux archives B 9 (cf. *ibid.*, 527, 541).

Wēdum-qarrad : il possédait un champ, d'après *TLB* 1 205 : 1-2 (1/v/Si 8), qui devait être proche du canal Ūbil-nuhšam, d'après le rattachement de ce texte au dossier des Rababéens.

5. CONCLUSION

Dans cette brève étude, on a tenté de réunir l'ensemble des attestations du canal Ūbil-nuhšam. Si on n'a pu déterminer la localisation géographique précise de ce cours d'eau, on a essayé de rassembler les différentes informations qui étaient en notre possession.

Ainsi, on sait que ce canal se trouvait dans la province du Yahrurum inférieur et qu'il devait être un des canaux importants de cette région. On a montré que d'autres canaux le rejoignaient, ce qui nous a permis de dresser une première esquisse d'une partie du réseau d'irrigation de cette province. D'autre part, on a pu constater que les terres cultivées le long de ce canal étaient aussi bien des champs que des vergers très certainement consacrés à la culture de palmiers. On peut noter que les statuts de ces terres étaient très variés, puisque des terrains appartenant à l'État côtoyaient les propriétés de particuliers.

Si on n'a pu arriver à une réponse définitive, une étude plus approfondie des textes de *YOS* 12 et des textes encore inédits (comme ceux de Yale) pourrait permettre d'avoir une idée plus complète de la géographie de la province du Yahrurum inférieur et de préciser la situation du canal à l'intérieur de celle-ci.

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62 Les abréviations utilisées ici sont celles qui se trouvent réunies dans *Northern Akkad Project Reports* 8 (Gand, 1993), 49-65.

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ARRIAN, *Anabasis* VII 21.1-4 AND THE PALLUKKATU CHANNEL*

by Tom BOIY ** and Kris VERHOEVEN ***

In the seventh book of the *Anabasis Alexandri*, Arrian describes in detail how the Παλλακόπας-channel at the time of Alexander the Great was being used to divert superfluous water from the Euphrates to marshes west of the river in order to avoid floods :

XXI. "... ἐκπλεῖ ἐκ Βαβυλῶνος κατὰ τὸν Εὐφράτην ὡς ἐπὶ τὸν Παλλακόπαν καλούμενον ποταμόν. Ἀπέχει δὲ οὗτος τῆς Βαβυλῶνος σταδίους ὅσον ὀκτακοσίους, καὶ ἔστι διώρυξ αὕτη ὁ Παλλακόπας ἐκ τοῦ Εὐφράτου, οὐχὶ δὲ ἐκ πηγῶν τις ἀνίσχων ποταμός. Ὁ γὰρ Εὐφράτης ποταμὸς ῥέων ἐκ τῶν Ἀρμενίων ὀρῶν χειμῶνος μὲν ὥρᾳ προχωρεῖ κατὰ τὰς ὄχθας, οἷα δὴ οὐ πολλοῦ ὄντος αὐτῷ τοῦ ὕδατος· ἦρος δὲ ὑποφαίνοντος καὶ πολὺ δὴ μάλιστα ὑπὸ τροπὰς ἅστινας τοῦ θέρους ὁ ἥλιος ἐπιστρέφει μέγας τε ἐπέρχεται καὶ ὑπερβάλλει ὑπὲρ τὰς ὄχθας ἐς τὴν γῆν τὴν Ἀσσυρίαν. Τηνικαῦτα γὰρ αἱ χιόνες αἱ ἐπὶ τοῖς ὄρεσι τοῖς Ἀρμενίοις κατατηκόμεναι αὔξουσιν αὐτῷ τὸ ὕδωρ ἐπὶ μέγα, ὅτι δὲ ἐπιπολῆς ἐστιν αὐτῷ καὶ ὑψηλὸς ὁ ῥοῦς, ὑπερβάλλει ἐς τὴν χώραν, εἰ μή τις ἀναστομώσας αὐτὸν κατὰ τὸν Παλλακόπαν ἐς τὰ ἕλη τε ἐκτρέψειε καὶ τὰς λίμνας, αἳ δὴ ἀρχόμεναι ἀπὸ ταύτης τῆς διώρυχος ἔστε ἐπὶ τὴν ξυνεχῆ τῇ τῶν Ἀράβων γῇ καὶ ἔνθεν μὲν ἐς τέναγος ἐπὶ πολύ, ἐκ δὲ τοῦ ἐς θάλασσαν κατὰ πολλά τε καὶ ἀφανῆ στόματα ἐκδιδοῦσι. Τετηκυίας δὲ τῆς χιόνος ἀμφὶ Πλειάδων μάλιστα δύσιν ὀλίγος τε ὁ Εὐφράτης ῥέει καὶ οὐδὲν μεῖον τὸ πολὺ αὐτοῦ κατὰ τὸν Παλλακόπαν ἐκδιδοῖ ἐς τὰς λίμνας. Εἰ δή τις μὴ ἀποφράξειε τὸν Παλλακόπαν αὖθις, ὡς κατὰ τὰς ὄχθας ἐκτραπὲν φέρεσθαι τὸ ὕδωρ κατὰ τὸν πόρον, ἐκένωσεν ἂν τὸν Εὐφράτην ἐς αὐτόν, ὡς μηδ' ἐπάρδεσθαι ἀπ' αὐτοῦ τὴν Ἀσσυρίαν γῆν."

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Changing Watercourses in Babylonia.
Towards a Reconstruction of the Ancient
Environment in Lower Mesopotamia I
(= *MHEM* 5/1), Ghent, Chicago, 1998, 147-158.

"... (Alexander) sailed from Babylon along the Euphrates to the so-called river Pallacopas. This is some eight hundred stades away from Babylon, and it is a channel from the Euphrates, not a river that rises from its own springs. For the Euphrates river flowing from the Armenian mountains runs within its banks in the winter season, as the volume of the water is not large; but once spring just shows, and especially about the time of the summer solstice, its flow is great and it breaks its banks on to the Assyrian land. For it is then that the snows on the Armenian mountains melt and increase its volume enormously. Since the bed of the stream is lifted high up, it would overflow into the surrounding country unless it were given an outlet along the Pallacopas and so turned into the marshes and the lakes, which begin with this channel and continue as far as the land nearest to Arabia, and thence it runs mostly into lagoons and thereafter into the sea by unnoticed mouths. When the melting of the snow is over about the setting of the Pleiades, the level of the Euphrates is low, and yet all the same most of the water flows by the Pallacopas into the lakes. If, then, the Pallacopas were not dammed in its turn, so that the water is diverted to run in the channel between its own banks, it would have drained off the Euphrates into it, and then it would never water the Assyrian plain." [1]

Appian [2] mentions a river Pallakottas which leads the water away from the Euphrates and prevents the irrigation of Assyria. Strabo [3] states that Alexander inspected several channels and he describes problems concerning a channel, the name of which is not mentioned, which links the Euphrates with marshes and lakes in the direction of Arabia. Both Strabo's and Arrian's stories were based on the Alexander history of Aristobulus.[4]

Already at the end of the nineteenth century, A. Delattre and B. Meissner discovered that Arrian's Pallakopas channel was to be identified with the Pallukkatu channel known from cuneiform documents.[5] On the basis of the Akkadian Pallukkatu, which occurs in numerous cuneiform tablets, they could clearly prove that Appian's notation Pallakottas was to be preferred above Arrian's Pallakopas.[6] As far as the

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1 Arrianus, *Anabasis* VII 21.1-4; the translation is based on BRUNT 1983, 277-279.

2 Appianus, *Bellum Civile* II 153.

3 Strabo XVI 1.11.

4 *FGrHist* 139 F 55 en 56.

5 DELATTRE 1888, 495 and MEISSNER 1896, 177-189. Meissner apparently did not know that Delattre had already suggested the identification with Pallukkatu eight years before his own article (POTTS 1997, 42, n. 9). For more recently published tablets mentioning the Pallukkatu channel see ZADOK 1985, 379 and JURSA 1995, 201-203.

6 Plinius' "Pallacontam fluminem" (*Naturalis Historia* VI 118) already showed that Appian's notation was correct.

geographical situation is concerned, Arrian was misread by most researchers in the nineteenth century. Because of the phrase "κατὰ τὸν Εὐφράτην" used by Arrian they situated the Pallukkatu channel south of Babylon.[7] Meissner already pointed out that "κατά" does not necessarily have to mean "down the Euphrates", but can simply be translated as "along the Euphrates". The verb "καταπλέω", on the other hand, must be translated as "sailing down the river". Only in VII 21.7 does Arrian make use of this verb, when he states that Alexander sailed to the channel and subsequently went on in the direction of Arabia through this channel (ἔπλευσε καὶ κατ' αὐτὸν καταπλεῖ). This passage allows for an interpretation in which Alexander headed north and at the beginning of the Pallukkatu channel sailed to the south. The most important argument is the logic of Arrian's story which also dictates a northern position for the channel : if a channel to protect Babylonia from disastrous floods were to be situated at 800 stades to the south of Babylon, it would have been useless for the greater part of Babylonia because most of the important cities were located more to the north. A further argument used by Meissner in favour of a more northerly position for the Pallukkatu channel is the town of Pallukkat's subordinate position to Sippar, as indicated in cuneiform documents from the Neo-Babylonian period.[8] In addition, the great majority of contracts mentioning the Pallukkatu channel belong to the Sippar collections of the British Museum,[9] which increases the probability of a Pallukkatu channel to the north of Babylon.[10]

Both Delattre and Meissner situated the channel north of Babylon. Delattre placed the beginning at Hīt, where the remains of an ancient channel were discovered.[11] Meissner did not situate the Pallukkatu channel so far to the north, and on etymological grounds he accepted Fallūğah as the starting point of the channel.[12] We will discuss the exact location of the channel later on.

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7 See MEISSNER 1896, 180-183.

8 *Nbn.* 506 and *Ner.* 18 report the delivery of barley and the payment of tithes to the Ebabbar.

9 82-9-18 and A.H. 83-1-18 (MEISSNER 1896, 186).

10 Despite these arguments some scholars in the twentieth century still located the Pallukkatu channel to the south of Babylon on the basis of Arrian's testimony : MUSIL 1927, 279-280 ; HUTZEL 1974, 262 and BOSWORTH 1988, 58, n. 63. Most modern translations of Arrian also suggest a position to the south of Babylon : BRUNT 1983, 277 (in Brunt's translation above we changed "down the Euphrates" to "along the Euphrates") ; SAVINEL 1984, 243 and WIRTH and VON HINÜBER 1985, 589.

11 DELATTRE 1888, 472-475. It had already been suggested by NIEBUHR (1774, 223-225) that Hīt was the starting point of the Pallukkatu channel.

12 The shift from Akkadian Pallukkatu to Syrian Pallugta to Arabic Fallūğah is quite acceptable (MEISSNER 1896, 186-187 and n. 1). The Semitic root PLG means "to divide" and can be considered an indication of a division of the river Euphrates (BARNETT 1963, 12). Until recently the identification with Fallūğah was generally accepted in academic literature ; cf. e.g. BARNETT 1963, 11 ; GIBSON 1972, 24 ; EDZARD and FARBER 1974, 252-253 and GRONEBERG 1980, 272 ; contra : COLE 1994, 83 and n. 6 (see also n. 33). All these researchers believed that this channel was already known in the Old Babylonian period as the

Meissner not only proved that "Pallakottas" was the same as "Pallukkatu", but he also demonstrated, via *Nbn.* 506, that the Pallukkatu channel was equipped with a sluice gate.[13] Apparently the channel could be cut off from the Euphrates, thereby fulfilling an important condition for taking Arrian's story seriously.

At this point, despite Meissner's arguments, there still could not be any certainty about Arrian's story on the diversion of superfluous waters from the Euphrates during springtime into marshes in the west. The cuneiform documents merely mention the Pallukkatu channel and its sluice gate and do not give any additional information on the hydrographical situation of the Euphrates.

To add further arguments to the discussion we can first of all compare *Anabasis Alexandri* VII 21.1-4 with data from Mesopotamian history. From the Old Babylonian period a letter [14] from king Hammurabi to Šamaš-ḫāzir describes a situation similar to the one in the story of Arrian. Hammurabi wrote to his subordinate that "the river streams further and there is much water", which means that the flood had already passed Babylon, and that "Šamaš-ḫāzir should open the channel which leads to the marshes in order to fill the marshes around Larsa", thereby protecting the city from floodwaters. Although the situation just described took place in the south of Iraq, the system of diverting water from the Euphrates to avoid floods is exactly the same as described by Arrian for the Pallukkatu channel.

In an article on marsh formation in the Borsippa region Cole [15] states that the system described by Arrian was already in use during the Neo-Babylonian and Achaemenian periods. The starting point of his argumentation is the observation of the existence of a marsh which had formed to the north of Borsippa between the eighth and fourth centuries BC. At the beginning of the sixth century BC, the dimensions of this marsh were so enormous that it was called *tâmtu*, the "Sea".[16] One of the city gates of Borsippa received the name "Sea Gate", and this "Sea" was still documented at the time of Darius I.[17] According to Cole, the water of this marsh must have been supplied by the Pallukkatu channel.[18]

"Abgal" (= *Apkallutu according to BARNETT 1963, 11). However, according to Frayne, the Apkallutu channel must have been situated to the east of the Araḫtu branch of the Euphrates, which makes an identification with the Pallukkatu channel impossible (FRAYNE 1992, 48-49).

13 *Nbn.* 506 l. 2 : TA KÁ $^{\text{íd}}$*pal-lu-ka-tum*.

14 *OECT* 3 7 = *AbB* 4 85.

15 COLE 1994, 81-109.

16 *TuM* 2/3 15 l. 2.

17 *VS* 3 161 l. 2.

18 "This body of standing water was so extensive by the reign of Nebuchadnezzar II that the inhabitants of the region began at that time to call it the "Sea". It was probably fed by the Pallukkatu channel, which left the west bank of the Euphrates not far below Sippar and functioned, it will be argued, as an escape system for the river at flood" (COLE 1994, 83). "The texts do not inform us of the immediate reasons for

By way of comparison Cole gives the situation of the Euphrates in the nineteenth and early twentieth centuries AD. At that time the Euphrates divided into two branches, the Šaṭṭ al-Hindīyah and the Šaṭṭ al-Ḥillah (see Fig. 3). Until 1914 the bulk of Euphrates water flowed through the Šaṭṭ al-Ḥillah, but the dam at its bifurcation required the constant attention of the Ottoman authorities, because at the slightest neglect the river would wash away all human-made obstacles to find a more westerly bed, thus drastically decreasing the water level of the Ḥillah branch. Such a breakthrough would have meant the loss of much Euphrates water, which would have disappeared into marshes to the west of the river. According to travel accounts from the nineteenth century this happened several times. John Punnett Peters, for example, wrote after a visit to Babylonia:

> "The Euphrates had been for some years flowing more and more into the Hindieh Canal, and thence into Abu Nejm and other great swamps. They told me that five years before, the revenues of the Mutessariflik, or province of Hillah, were eighty-five thousand Turkish liras, but in 1889 they were only ten thousand. This difficulty with the Hindieh Canal is an almost periodical one. From the remotest antiquity the Euphrates has broken down all dams and dispersed itself through the Hindieh into the great swamps, at uncertain intervals, depending upon the strength of the dam and the watchfulness of the government.[19]"

Cole's explanation and argumentation indeed suggest a situation similar to the one described by Arrian. However, it could not be proven on the basis of cuneiform documents that the Pallukkatu channel was indeed the waterway through which superfluous waters from the Euphrates were carried into the marshes.

The recent publication of the Astronomical Diaries [20] allows us to accept for the Pallukkatu channel in the Hellenistic period a system similar to the diversion of floodwaters into the marshes around Larsa in the Old Babylonian period. At the same time we think we can prove that Cole's conjecture concerning the Pallukkatu channel as a supply channel for marshes to the west of the Euphrates is correct.[21]

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these hydrological changes. We can be reasonably certain, however, that the channel through which this water entered the Borsippa region was the Pallukkatu and the marsh which it formed was that which came to be called *Tâmtu*, the "Sea" (*idem*, p. 87). "The principal watercourse through which floodwaters entered this morass was undoubtedly the Pallukkatu, which during Neriglissar's reign began to be mentioned regularly for the first time in over a millennium" (*idem*, p. 95).

19 PETERS 1897, 213.

20 SACHS and HUNGER 1988-1996.

21 The importance of the Astronomical Diaries in determining the use of the Pallukkatu channel was already noticed by JURSA 1995, 202, n. 394.

In addition to the town of Pallukkat,[22] the Astronomical Diaries mention the Pallukkatu channel five times :

-332B Obv. 6' : [...]*se-ke-ri šá* $^{\text{íd}}$*pal-lu-ka*-[*tu*$_{4}$...]
-328 Obv. 26 : [...]2 KÙŠ 8 SI *ina se-ke-er šá* $^{\text{íd}}$*pal-lu-kát* GI[N...]
-324A Rev. 13' : [...$^{\text{í}}$]$^{\text{d}}$*pal-lu-kàt*
-105D Flake 9' : [...] $^{\text{íd}}$IBILA-*uk-k*[*at*...]
-77B Obv. 26' : *ina se-ke-er šá* $^{\text{íd}}$IBILA-*uk-kat* [...]

Each time the Pallukkatu channel is mentioned in these documents it is in connection with the water level of the Euphrates at Babylon. Apart from astronomical observations the Diaries also furnish information on topics such as weather conditions, commodity prices, the water level of the Euphrates at Babylon and some historical notes. As far as the water level is concerned, they note when and how much the water rose or fell and when the water level remained unchanged. The earliest Diaries provide only relative water levels. It was not until the end of the fourth century BC that an absolute standard was introduced: the "*na*". The *na* was either a gauge or a measure indicating from a fixed point downwards the level of the Euphrates at Babylon. According to Hunger [23] the fixed point was probably some high part of a sluice gate in Babylon from which the measurements were taken. When *na* equalled 0, there was an immediate danger of flooding in Babylon, but as the water level decreased, the higher the value of *na* became. In other words, the value of *na* is inversely proportional to the height of the water level. The fluctuations of the water level are measured in cubits and fingers, with 1 *na* equalling 4 fingers or 1/6 cubit.

An analysis of approximately 300 measures of *na* found in the Astronomical Diaries reflects some well-known phenomena. As expected, the highest water level of the Euphrates was around the months April-May. An examination of 29 cases with a *na* of less than 6 showed that 19 could be placed with certainty within the months April-May. In -156A Obv. 19' (April/May), -140A Obv. 19 (June/July) and -105A Obv. 13' (April/May) there was a *na* of 0 (*na* NU TUK). Apart from these 29 examples of high water levels there were ten situations described in the Diaries as peak flood [24] and one of almost peak flood.[25]

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22 -373A Obv. 9'.

23 SACHS and HUNGER 1988-1996, vol. 1, 34-36.

24 251 U.E. 2 (March), -246 Obv. 11 (April/May), -245A Obv. 11 (April/May), -207A Obv. 17 (April/May), -204C Rev. 12 (April), -197B Rev. 27' (end of March/beginning of April), -156A Obv. 19' (April/May), -140A Obv. 19 (April/May), -134B Rev. 8' (January/February), -105A Obv. 13' (April/May).

25 -567 Obv. 6. Some caution in regard to the number of high water cases is called for. The water level of April/May 141 BC, for example, is mentioned no fewer than three times in the figures above: in -140A Obv. 19 we find first a *na* of 0, then a *na* of 3 and eventually a peak flood is mentioned. April/May 157 BC is represented even more frequently: *na*-values of 4, 2 and 0 and a river level of 2 fingers above peak

The low water levels paint a picture which is much more disparate. In general we can say that the majority of low water levels are found around the months September-October, but some occur as early as August or as late as February. The highest *na* value is 39, which occurred in 123/2 BC.[26] Furthermore, the Diaries twice exhibit the values 37 [27] and 36.[28] Starting from 35 there are more examples. In addition it is important to note that in -190D U.E. 1-2 the water level had increased by four fingers immediately before the *na* was 37, so we can add a *na* of 38 during the days before. A similar situation is found in -118A Rev. 18' (October/November), where a *na* of 33 is preceded by a rise in the water level of no less than 1 cubit, which means that the *na* was previously 39.

240 of these 300 water level data can be attributed to a month of the Julian calendar. The average of *na* for each month (see Fig. 1) gives the same picture as described above: high water in the months April-June and low water in August-November. The present-day regime has the same regularity (see Fig. 2).[29]

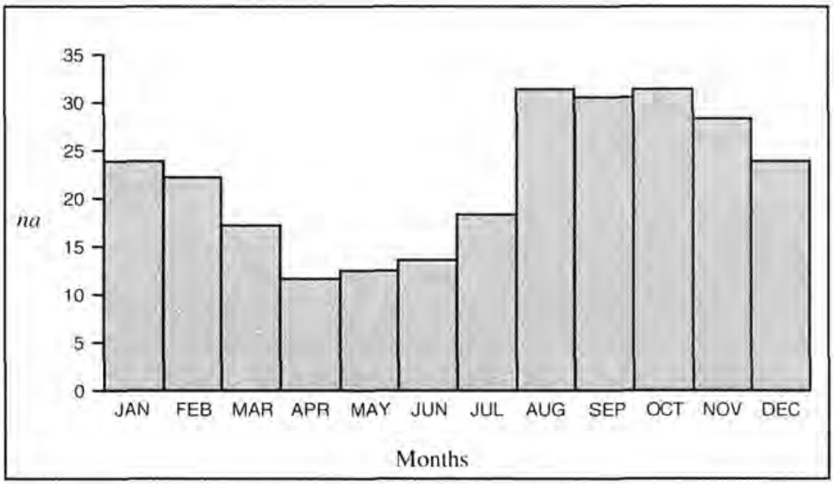

Fig. 1. Water Level of the Euphrates in the Hellenistic Period Expressed in *na*/Julian Month.

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flood are all attested for this month.

[26] -122D Rev. 9' (month unknown).

[27] -190D U.E. 2 (November/December) and -178A Rev. 5' (August/September).

[28] -186C Rev. 13 (February) en -77B Obv. 11' (October).

[29] SLOTSKY (1997, 88-98) also analysed observations of the level of the Euphrates in the Astronomical Diaries, but only those found in combination with market quotations. The results, presented in Fig. 30 (*idem*, p. 94), are comparable.

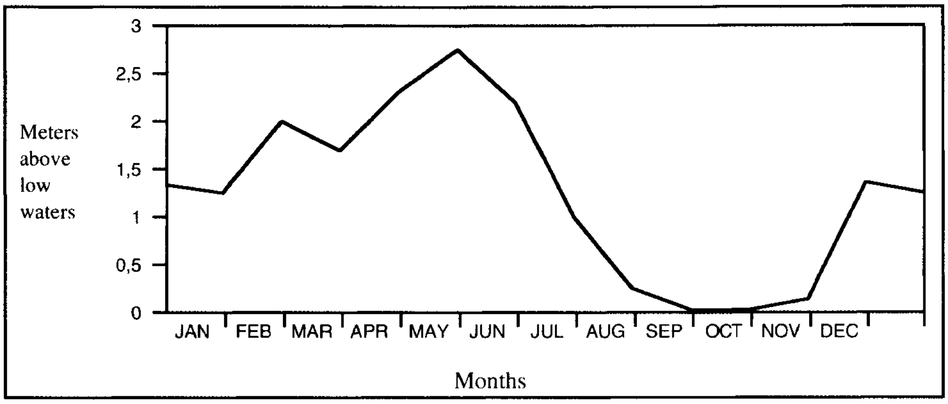

Fig. 2. Water Level of the Euphrates in Modern Times Expressed in Meters above Low Water/Month. Graphic after FISCHER 1971^{5}, 347, and Fig. 15.2.

The passage concerning the closing of the Pallukkatu channel in -332B (September) is too fragmentary to provide any useful information. -328 (October/ November) on the other hand clearly states that there was an increase of 2 cubits and 8 fingers in the level of the Euphrates at a time when the Pallukkatu channel was closed. On the *na* scale this would mean a value of 14, which is quite substantial when one considers that the scale in question has only 39 units from its lowest to its (as far as we know) highest point. In -77B, finally, the closing of the Pallukkatu channel is even more directly linked with a low level of the Euphrates. The closing took place in the month Araḫsamnu, and in the previous month there had been a *na* of 36, an exceptionally high value (which means low water level) in comparison with other water-level values at Babylon in the Hellenistic period. We do not have any explicit attestations of the opening of the Pallukkatu channel in springtime during times of high water, but the Astronomical Diaries at least prove that the Pallukkatu channel was closed when the water level of the Euphrates was too low.

As far as the opening of channels during springtime is concerned, the Astronomical Diaries provide some material for comparison. Similar to the passages which mention the closing of the Pallukkatu channel during times of low water. -108A Obv. 29' mentions the opening of a channel (?) (*ina pe-te-e ša* ÍD *ḫi-ir*$^{?}$-[*ti*$^{?}$] when there was a high water level (*na* = 4).

The point of departure of the Pallukkatu channel from the Euphrates and the exact position of its bed have not been fully clarified. We have already explained above that the channel must have been situated north of Babylon, as was correctly noted by Delattre and Meissner.

On the basis of its supposed etymology, Meissner situated the mouth of the Pallukkatu at present-day Fallūğah, and he was followed by almost the entire academic

world.[30] This view is based solely on etymological arguments and does not take into account the geomorphological situation west of the present bed of the Euphrates. Etymology is without doubt useful in this context, but it has to be handled with care: shifts of habitation centres and consequently of geographical names occur frequently. If we consider the geomorphological situation west of the Euphrates at Fallūğah, a gypsiferous plate here makes any waterway on this side of the river impossible. A bit upstream from Fallūğah on the other hand, a clear depression is visible at the height of the present Ḥabbānīyah and Abū Dibbīs Lakes (see Fig. 3). This location would be perfect for a channel to divert superfluous water from the Euphrates, but the numerous attestations of the Pallukkatu channel in cuneiform tablets from Sippar makes a position so far to the north rather unlikely.[31]

Another possible location for the Pallukkatu channel is the break in the gypsiferous spur which extends to a point some 25 km southeast of Sippar. The present-day Euphrates flows through this break. There is no way at present to know if the spur was already breached in the first millennium BC; there are no indications that it was, but there are no arguments against it either[32] (see Fig. 3). This location must be considered as a more likely candidate; since it is situated in the vicinity of Sippar, the appearance of the channel in the tablets from this city is quite logical. The exact place where the Pallukkatu channel departed from the Euphrates remains unknown.

There is general agreement on the approximate location of the channel-bed further downstream. When the more eastern bed of the present-day Euphrates is considered, the most obvious location of the Pallukkatu channel is one coinciding approximately with the line of the present Hindīyah branch of the river.[33]

Meissner's research at the end of the nineteenth century and the new information on water levels in Babylon brought to light by the Astronomical Diaries have made it

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[30] See n. 12 above.

[31] At present the main purpose of the Ḥabbānīyah lake is to store water for irrigation, but flood prevention is also an important task of this reservoir (HATIM 1977, 265). The only argument for such a northern location, apart from the etymology, is Arrian's distance from Babylon of 800 stades (according to the Attic standard around 150 km). Along the ancient bed of the Euphrates 150 km north of Babylon would mean a location somewhere in the neighbourhood of the lakes and Fallūğah.

[32] COLE (1994, 83 and n. 6) proposes a position below Sippar because he presumed, on the basis of a survey by the Belgian Archaeological Expedition to Iraq, that the gypsiferous desert spur was not yet breached in antiquity. At present he reviewed this theory and he thinks the break could already have taken place and a more northern position is possible (oral communication January 1998; see also BRINKMAN 1995, 22 and n. 27). Cole thinks that *Nbn.* 506 ll. 2-3 may be a clue to the location of the Pallukkatu channel: the mountain in "TA KÁ [íd]*pal-lu-ka-tum ... a-di* KUR-*i*" might refer to the end of the spur, which is somewhat higher than the surrounding environment.

[33] GIBSON 1972, 24; EDZARD and FARBER 1974, 253 and GRONEBERG 1980, 272; contra G. van Driel, who questions the existence of a Pallukkatu channel departing from the right bank of the Euphrates and thinks that a left-bank channel makes more sense (VAN DRIEL 1988, 128).

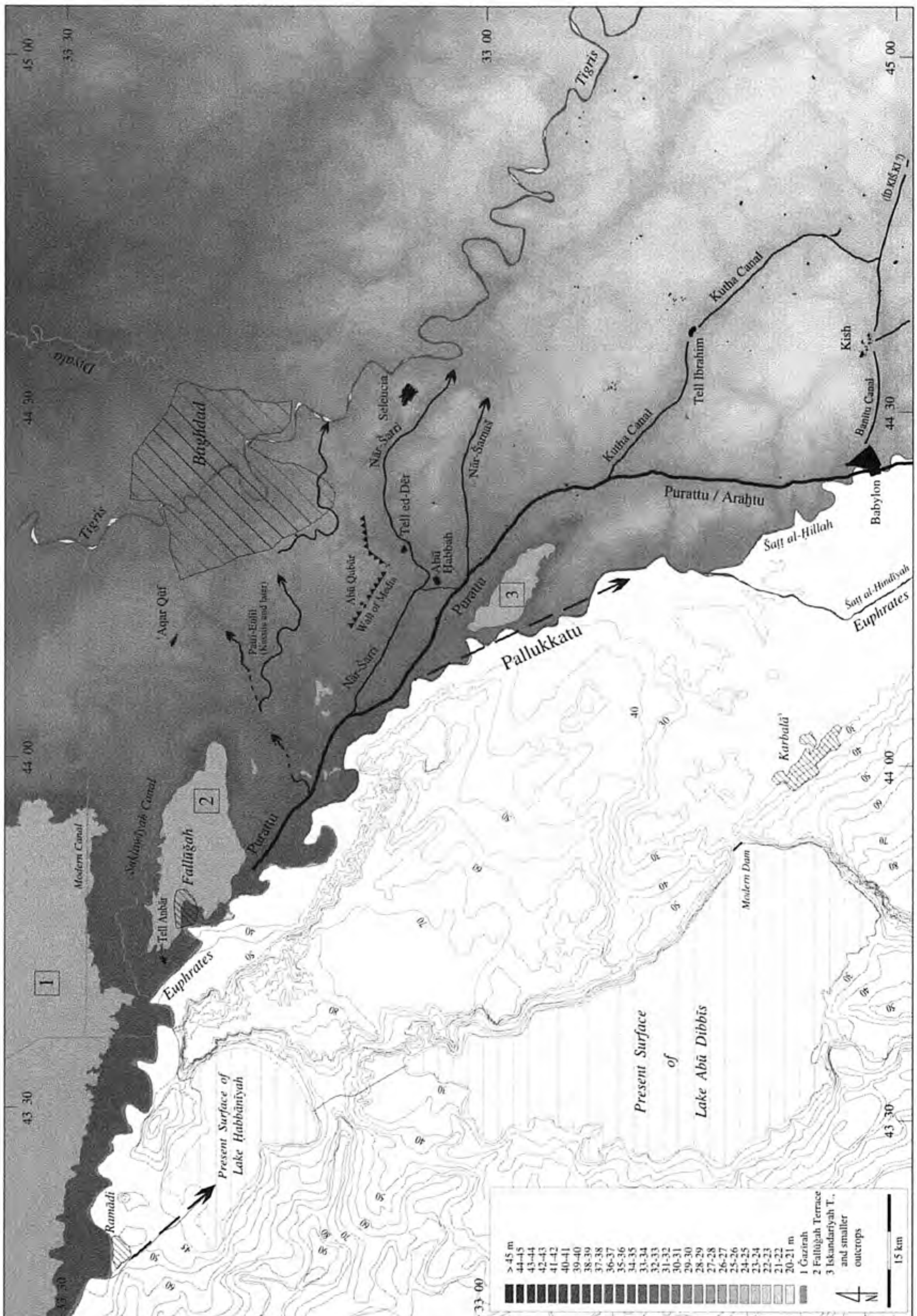

Fig. 3. Proposal for the Location of the Pallukkatu Channel.

possible to confirm Arrian's story of diverting superfluous Euphrates water. When the water level of the Euphrates in springtime reached a level that was sufficiently high, the sluice gates of the Pallukkatu channel were opened to prevent floods in Babylonia, with the water being diverted into marshes, the existence of which has been shown by Cole. When the water level of the Euphrates was low, the Pallukkatu channel was closed again. Arrian's explanation that there would otherwise be a shortage of irrigation water seems quite logical. The exact location of the channel-bed can not be deduced from cuneiform tablets. From a geomorphological point of view both the depression in which the Ḥabbānīyah and Abū Dibbīs Lakes are located and the passage of the present-day Euphrates through a gypsiferous plate south of Sippar are likely candidates. Because of the appearance of the Pallukkatu channel in several cuneiform tablets from Sippar we prefer the latter possibility.

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GEOMORPHOLOGICAL RESEARCH IN THE MESOPOTAMIAN FLOOD PLAIN

by Kris VERHOEVEN *

"... *the fluvial system is a physical system with a history.*"
(SCHUMM 1977, 10)

1. INTRODUCTION

In the context of the Belgian Archaeological Expedition to Iraq (1988-1990) the author had the opportunity to carry out a geomorphological reconnaissance survey of the immediate surroundings of the archaeological sites of Tell ed-Dēr, Abū Ḥabbah (Sippar), and Abū Qubūr, 20 km southwest of Baghdad. The field work consisted of descriptions of an elaborate hand-auger transect perpendicular to the course of an old river levee of the Euphrates. Granulometric analyses were done on some samples in the lab.[1]

The study area had already been the subject of some geomorphological research carried out by Gasche, Nijs, De Meyer, Baeteman, and Paepe.[2] The authors focused on the geographical settings of the old river levees and flood basins, especially in relation to the archaeological remains and the old irrigation canals. A substantial part of their research is integrated into this contribution.

This article concentrates first on the geomorphology of the Mesopotamian flood plain in general (macro-scale). In this first part, comprising roughly the first half of the article, the main physiographical units of the Mesopotamian Plain are described, concentrating on the flood plain of the Euphrates and Tigris, including its general characteristics and morphology, as well as brief descriptions of the Euphrates-Tigris-Karūn deltaic complex and of the sedimentation history of the Gulf. This comprises Section 2. Then in Sections 3-4 of this first part are treated the principles governing changes in fluvial systems in general and the potential effects on river regimes of fluctuations in environmental conditions (as yet poorly understood). This, we believe, sets the stage and provides the backdrop for a detailed

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* University of Ghent. I acknowledge with gratitude the support and comments of L. De Meyer, M. Tanret, G. Stoops, R. Nijs, H. Gasche, and S. Cole in this undertaking. I thank S. Cole for linguistic corrections as well. However, all statements, interpretations, and conclusions are mine alone.

1 The field work was planned on the assumption that it was the start of a long-term project of field research on the reconstruction of the palaeo-environment and history of Mesopotamia. Appropriate sampling of key locations, especially for radiocarbon datings or proxy data records, were postponed to be taken at other field occasions. Unfortunately, after 1991 no field work could be done.

2 GASCHE 1985, 1988 ; NIJS 1987 ; GASCHE and DE MEYER 1980 ; BAETEMAN 1980 ; PAEPE and BAETEMAN 1978 ; PAEPE 1971. See also Cole and Gasche in this volume for other general references relevant to the geomorphology of the flood plain.

Changing Watercourses in Babylonia.
Towards a Reconstruction of the Ancient
Environment in Lower Mesopotamia 1
(= *MHEM* 5/1), Ghent, Chicago, 1998, 159-245.

introduction to, and treatment of, the main actors in the drama of the Lower Mesopotamian landscape : the Twin Rivers (Section 5).

In the second part of the article and comprising approximately its next quarter, the palaeo-fluviatile environment of the northern part of the Euphrates-Tigris flood plain is treated in greater detail (meso-scale). Included are descriptions of the rivers' present flow regime, the present topography of their flood plain in this region, the present and relict landforms, as well as present and past irrigation patterns (Section 6). This section is intended to provide the background and rationale for our geomorphological research program in the region of Tell ed-Dēr, Abū Ḥabbah, and Abū Qubūr.

Finally, in the last quarter of the article (Section 7), the auger transect itself is described and the identification of the old river courses of the Euphrates in the study area is considered (micro-scale).[3]

Based on this research, and with reference to the work of Cole and Gasche, conclusions are drawn and a general working hypothesis is proposed for the reconstruction of the fluvial landscape in the northern part of the Mesopotamian flood plain during the second half of the Holocene.[4] Briefly stated, the author tentatively proposes that after the early-middle Holocene there was a gradual transition from a multi-channel anastomosing pattern in the Euphrates system in the study area to a single-channel meandering one. Based on the documentary record, this transition was not completed until sometime between the late Old Babylonian period and c. 900 BC (according to the conclusions of Cole and Gasche, a summary of which may be found in Section 7.5 below). After this transitional phase, the sedimentation pattern is strongly influenced by anthropogenic factors.

The author is well aware that in the absence of detailed profile-section descriptions, mineralogical, geo- and biochemical analysis, and radiometric data of the different sedimentary settings, no far reaching conclusions can be made. Therefore, any attempt to reconstruct, even in broad outline, the ancient landscape of this remote period can be only tentative. Needless to say, this hypothesis has to be modified with much more geoarchaeological research.[5]

2. Geographical Location and Main Physiographic Units of the Lower Mesopotamian Plain

The study area is part of what we call here the Mesopotamian meandering rivers flood plain. Presently it is dominated by the single-channel meander belts of the Euphrates and Tigris and their associated Holocene flood plain deposits and landforms. It corresponds with the upper part of the Lower Mesopotamian Plain, defined by Buringh (1960, 38) "*...as the*

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3 According to Butzer (1982, 8), *microscale and macroscale studies obviously are complementary, and both are necessary for comprehensive interpretation.*

4 The Holocene comprises roughly the last 11500 Cal yr BP (Roberts 1998, 22).

5 For foundations and general procedures in geoarchaeology, see e.g. Butzer 1982 ; Rapp and Hill 1998.

southern part of an extensive geosyncline, which at the bottom (approximately 3 kilometers under the present surface) is filled up with older shelf sediments, on top of which erosional products have been deposited."

In the northeastern part the Lower Mesopotamian Plain is delimited by the Pleistocene/Holocene fan piedmont, on pedisediments of the Zagros Mountains, which is intersected by intermittent streams and internally drained basins or swamps.[6] The southwestern limit corresponds with the Tertiary sediments of the Western Plateau[7] and relict[8] fans or fanglomerates associated with palaeo-drainage systems coming from the Arabian Peninsula during Pleistocene humid phases.[9] This desert area is characterized by many ephemeral streams, generally oriented perpendicularly to the flow of the Euphrates. In the northwest the gravelly, gypsiferous crusted deposits of the Lower Ǧazīrah terraces of Pleistocene age form a clear boundary. Finally, the Gulf and estuarine sabkha delimit the southeastern part (JASSIM *et al.* 1986). Figure 1 depicts schematically the main physiographic units and bordering units of the Lower Mesopotamian Plain. A brief description will be given below.[10]

The Lower Mesopotamian Plain is dominated by Holocene landforms deposited or modified by fluvial, eolian, lacustrine, peritidal, and anthropogenic processes.[11]

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[6] Most of the definitions of landforms that are used here conform with the recommendations made by the SOIL SURVEY STAFF, Natural Resources Conservation Service, National Soil Survey Handbook, title 430-VI (Washington D.C., U.S. Government Printing Office, December 1997). Especially part 629, *Glossary of Landform and Geologic Terms,* provides preferred or appropriate definitions for terms that have several definitions in general use. Consultable at *http ://www.statlab.iastate.edu/soils/nssh/* (last revision 11/17/98).

[7] The Western Plateau combines the physiographic units of the Northern and Southern Desert as defined by BURINGH (1960, 34, Fig. 13).

[8] Here relict landforms are used as a synonym for inherited landforms : landforms that are found out of equilibrium with present geomorphic processes. Relict landforms have been interpreted as being inherited from a past climatic regime, and as such they are the most diagnostic evidence of past climates (FAIRBRIDGE 1970, 99).

[9] The present ephemeral stream, the Wādī Bāṭin, is associated with such a palaeo-drainage system. This system formed, during the humid phases of the Pliocene-Pleistocene transition and the semi-humid phases of the Pleistocene, a huge alluvial fan (approximate radius 150 km) south of Baṣra. This fan changed the direction of the Euphrates eastwards (SANLAVILLE 1989, 10). Southwest of Karbalā' a similar fan, minor in extent, can be identified. Compare this with the palaeo-drainage system of the Arabian Peninsula (SANLAVILLE 1992, 6, Fig. 2). Together with the progressive inland delta formation of the Karūn river, east from the Šaṭṭ al-ʿArab, the fan of the Wādī Bāṭin forms a kind of bottle-neck for the Tigris and Euphrates on their way to the Gulf. It is thought that this narrowing impedes water flow on the Mesopotamian Plain and that this *is one of the factors responsible for the upstream development of extensive palustrine environments* (BALTZER and PURSER 1990, 188).

[10] Reliable, first source data are inaccessible, and even good topographical maps are available only spottily. Because of the lack of precise and accurate data the descriptions given here are unfortunately only qualitative.

[11] Other processes, like local subsidence, compaction, neo-tectonics, liquefaction, mass movements, etc., must have been, and still are, important. However, in essence and presently, the Lower Mesopotamian Plain is a plain of accretion (aggradation). Nearly all suspended sediment carried by the Euphrates and Tigris is deposited in the Lower Mesopotamian Plain (BURINGH 1960, 52). During the extreme flood year of 1953, the total sediment carried by the Tigris in that one year was estimated at 111.304.000 m^3 (BURINGH 1960,

By far the most important landforms of this plain are fluvial in origin and if we apply the definition of flood plain strictly to *that part of the nearly level plain that borders a stream and is subject to inundation under* natural *flood-stage conditions*, most of the Lower Mesopotamian Plain can be classified as flood plains.[12] Despite the fact that these *natural* conditions ceased in 1956 when the first modern flood control projects on the Euphrates and Tigris were finished (BURINGH 1960, 121), and despite the fact that anthropogenic factors since historical times [13] — although difficult to assess — strongly interfered [14] with these *natural* conditions, the Lower Mesopotamian Plain still clearly displays landforms that can be attributed to natural flood plain processes [15] (Figure 2). In turn, these flood plain processes must have determined — again difficult to assess — the possibilities and limits of the *Hydraulic Civilizations* of the Mesopotamian Plain.

At a macro-scale [16] we can subdivide the Lower Mesopotamian Plain into three macro-units. These units are approximately delimited in Figure 1. They are arbitrarily called the relict [17] flood plain, the present flood plain of the Euphrates and Tigris, and the fluviolacustrine-deltaic complex of the Euphrates-Tigris-Karūn.

2.1. The Relict (Pleistocene) Flood Plain, Terraces, and the Lower Ǧazīrah

On a mega-tectonic scale, the Mesopotamian and Gulf geosyncline reflects the collision of the Arabian and Euro-Asian plates which began in Pliocene times. A broad, asymmetrical, structural depression was formed, which extended from Hormuz to Syria (BALTZER and PURSER 1990, 176). This became an extensive sedimentary basin, strongly

51). This represents enough sediment to cover present-day Baghdad (approximately 444 km^2) with a sediment blanket of 25 cm. In flood, the Tigris sediment load may reach five times that of the Nile and more than three times the highest level known for the Euphrates (ADAMS 1981, 7). LEES and FALCON (1952, 29) used for their calculations a mean annual sediment load, for both the Tigris and Euphrates together, of 21.500.000 m^3. AQRAWI and EVANS (1994, 757) give for the annual suspended sediment content of both the Tigris and the Euphrates a value of 50-100 x10^6 tonnes ; with a particle density of 2.6 g/cm^3 this represents 19-38 x 10^6 m^3. See also SANLAVILLE 1989, 12.

12 Below high flood level.

13 During the Early Dynastic period work on the watercourses became a main concern of the organized state (ROWTON 1969, 310).

14 See for example ARRIAN, Anabasis Alexandri, VII, 21, 3-7 on deliberate channel bank opening during flood (breaching of the Euphrates into a canal and finally into the marshes) and high labor efforts for channel bank restoration (blocking) of the Euphrates (to bring again, after the flood, the Euphrates into the natural channel bed). For still earlier evidence of anthropogenic interference, see Cole and Gasche, this volume, pp. 7-13. Perhaps the most recent extensive inundations deliberately accomplished by river bank cutting were the strategic inundations caused by Iraqis in the Ḥabbānīyah region and ʿAqar Qūf depression during WWII in May 1941 in order to prevent the British advance on Baghdad (GLUBB 1959, 243). Such strategic inundations are already attested in the Ur III period (ROWTON 1969, 309). For the Islamic period see ADAMS 1965, 86.

15 Inasmuch as these are still active processes, we cannot estimate.

16 Here arbitrarily set as follows : macro > 100 km ; meso 100-1 km ; micro < 1 km.

17 These units are roughly delimited and apply only to the major landforms. Of course, relict landforms also occur in the present flood plain.

affected by clastic siliceous and calcareous sedimentation from surrounding areas. In the northern part of the Plain (macro-unit I on Figure 1), this sedimentation is mainly associated with the relict fluvial systems of Pleistocene age.

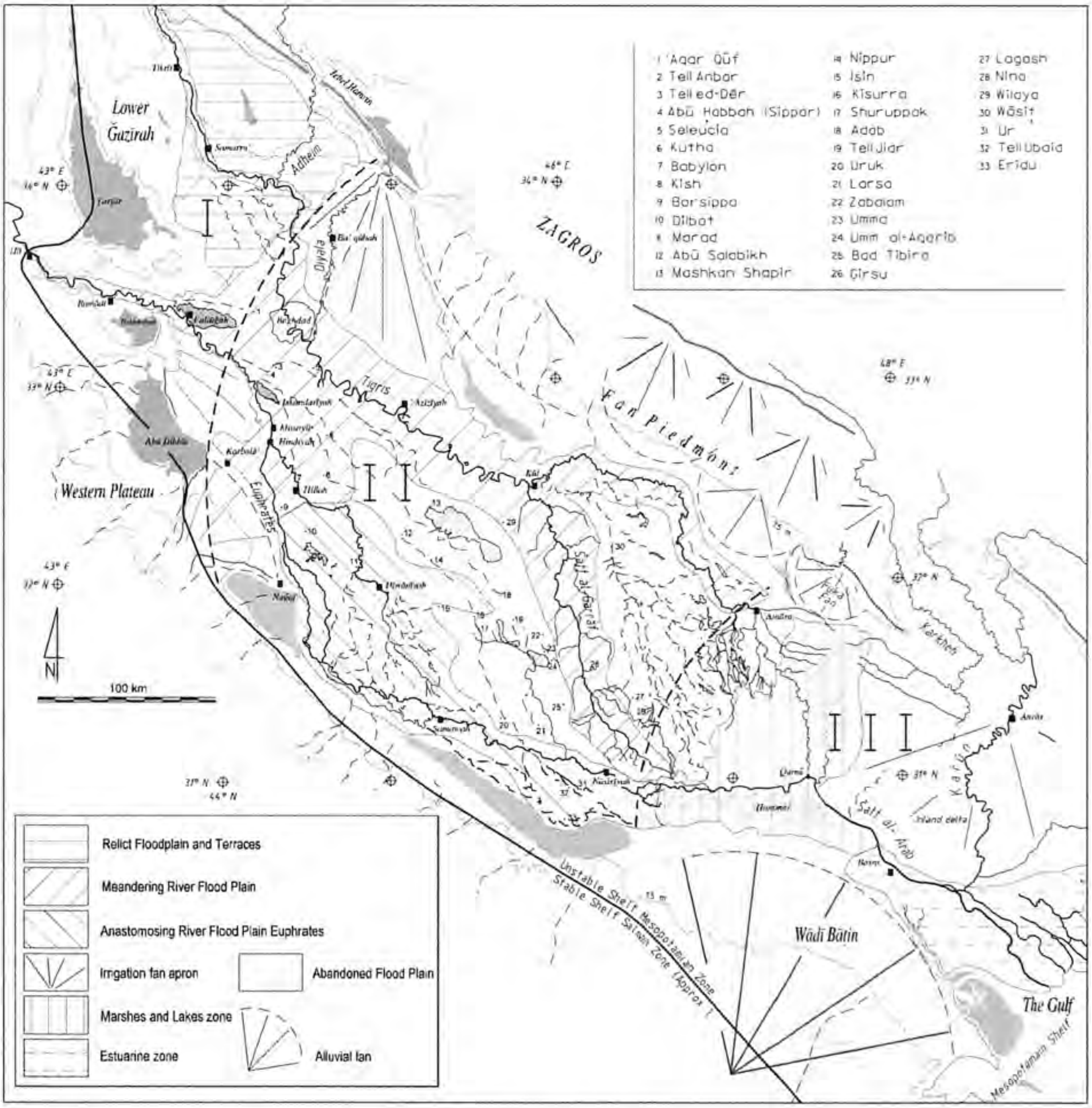

Fig. 1. Schematic Representation of the Major Physiographic Units in the Lower Mesopotamian Plain. Macro-unit : I= Relict (Pleistocene) Flood Plain ; II= Present Flood Plain of the Euphrates and the Tigris ; III= Fluviolacustrine-Deltaic Complex of the Euphrates-Tigris-Karūn. For general 'archaeological' orientation some important sites were added, regardless of their period of occupation. Compiled and generalized from various sources, among them SPOT multi-temporal, panchromatic images (1990-1991) ; BURINGH 1960 Map 1 and JASSIM *et al.* 1986.

The Lower Ǧazīrah, which corresponds with the *gypsum desert land* soil unit,[18] is mainly developed on gypsum, which is often exposed at the surface in a polygonal pattern (BURINGH 1960, 198). Central in this unit is the Ṯarṯār depression. Before it was used as a storage basin for Tigris water, diverted near the barrage at Sāmarrā' since 1956, the present Ṯarṯār lake was a large playa (BURINGH 1960, 198). The origin of this depression was attributed to down-faulting or to wind erosion.[19] The gypsum is attributed to the Lower Fars Formation as deposits in inland seas during the Miocene (BURINGH 1960, 40).

However, the main landforms and landscapes in this macro-unit must have been formed or modified during Pleistocene phases of erosion and deposition. These include the formation of various terraces, strongly gullied areas, secondary gypsum crusts, major alluvial fans along the Jebel Hamrīn, and most importantly, the deposition of gravelly and sandy flood plains (relict flood plain sediments, usually associated with high-energy braided river systems). At present these relict flood plain sediments form depositional terraces.[20]

BURINGH (1960, 123) described three terrace levels along the Tigris : the high, middle, and lower terrace. What follows is a brief description of his survey.[21] The geographical extensions of these landforms are schematized [22] in Figure 11.

The highest terrace lies approximately 15-20 meters above the present Tigris. Apart from the top few meters, the texture of the deposits consists of sub-rounded pebbles and gravels in a finer matrix, deposited in a braided river system environment (BURINGH 1960, 123). The high terrace southwest of Sāmarrā' and west of the Tigris has all the same characteristics and is attributed to the course of an ancient (early Pleistocene) Tigris river. It is the oldest river course found in Iraq (BURINGH 1960, 129). The gypsiferous gravelly terraces near Fallūǧah and Iskandarīyah also belong to the highest terrace, but probably of the Euphrates (BURINGH 1960, 129).

The deposits of the middle terrace are more uniform and much finer (gravelly clay) in texture (BURINGH 1960, 130-131). These materials have been deposited after an erosional phase of the high terrace.

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18 BURINGH 1960, Map 1 (Exploratory Soil Map).

19 BURINGH 1960, 198 citing WILLIAMS 1945 and MITCHEN 1948. Note however that the boundary stable/unstable shelf runs in the middle of the depression (Figure 1). MITCHELL (1957, 570) gives some evidence for a series of recent east-west upwarps (or fault movements) that caused the blockage of the former southward drainage of the Ṯarṯār into the modern Euphrates near Ramādi.

20 The geographical extent of this unit corresponds with the physiographic unit of the *Older Fluviatile Terraces* (River Terraces) of BURINGH (1960 122, Fig. 47). Other terraces of the Euphrates were mapped between the Euphrates and the Ṯarṯār Lake, east of Hīt (JASSIM *et al.* 1986). Near the Abū Dibbīs depression, BURINGH (1960, 133) also mentions a lower terrace of the Euphrates, but without further details.

21 BURINGH 1960, 123-143 and 242-248. We are not aware of other (accessible) geomorphological research in this area.

22 Initially BURINGH (1960, Map 1) defined more units for the *older fluviatile terraces* (BURINGH 1960, 124, Fig. 49). The three units of the gravelly high terrace, the gravelly clay middle terrace, and the silty clay low terrace are the ones that appear on his soil map of Iraq.

The lower terrace — finer in texture (silt or fine sand) than the former — in the area along the Tigris and Adheim Rivers is approximately 10-15 meters above their present beds (BURINGH 1960, 133). Large areas on both sides of the latter are covered with thick silty irrigation deposits resulting from former irrigation practices [23] and show the characteristic micro-topography of silty loam irrigation levees and silty clay irrigation depressions and gilgai relief (BURINGH 1960, 134-136).

On the exploratory soil map of BURINGH (1960, Map 1) these three terraces form three separate units, based mainly on their texture. They include the *gypsiferous gravel* soil (high terrace), the *gravelly older river plain* soils (middle terrace), and the *older river plain* soils, *silted phase* (lower terrace, reflecting the irrigation sediments).

BURINGH (1960, 247) places the deposition and formation of the terraces within the Pleistocene climatic-changes concept of the 1960s, when there was more evidence that glacial periods at higher latitudes corresponded with pluvial periods [24] in low latitude areas.

WILKINSON (1990) describes the Holocene changes in the course of the Tigris south of Sāmarrāʾ. He outlined the channel pattern of an earlier Tigris course flowing south-southeast from Sāmarrāʾ as a broad meander belt (here interpreted as a meandering river flood plain) with more braided traces in the north and well-developed meanders in the south and east. Although they cannot be dated with confidence, these traces of stream channels are the oldest in this area and are approximately associated with an early Holocene river system (8.000 BC - 3/4.000 BC) (WILKINSON 1990, 126, and Fig. 3).

These traces cover almost entirely the area of the middle terrace unit south of Sāmarrāʾ as delimited by Buringh. He also describes this middle terrace south and southeast of Sāmarrāʾ as an eroded surface of the high terrace, *where afterwards rather uniform material has been deposited during periods of high floods, forming the middle terrace* (BURINGH 1960, 131). If this uniform material corresponds with the relict flood plain deposits of the early Holocene Tigris course, then this middle terrace is much younger, and its formation cannot be correlated with Pleistocene climatic changes. If so, this middle terrace should be defined as a relict flood plain and the changes of the Tigris during the early Holocene as normal avulsion processes. As a consequence, the history of the landforms in this relict flood plain zone would be more recent than is usually accepted.

The lower terrace covers approximately the area north of the line Sāmarrāʾ-Baʿqūbah. The Adheim River and its eastern abandoned channel run in the middle of it. At present the Adheim River is strongly incised in this material, favoring strong gully erosion (BURINGH

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23 BURINGH (1960, 140) gives an Abbasid, probably Sasanian dating. Major canal off-takes from the left bank of the Tigris north and south of Sāmarrāʾ date from Sasanian times and later. Some of them were used during the Sasanian and Early Islamic periods as supply canals for the Nahrawān, which supplied the Diyala Plains, northeast of present Baghdad, with irrigation water (WILKINSON 1990, 122).

24 BUTZER (1975, 394) correlates this lower terrace with late Pleistocene terraces in Syria and he attributes other late Pleistocene terraces on the Ǧazīrah Plain to greater discharges.

1960, 134). Taking into account the extent of the catchment area, the discharge [25] of the Adheim is remarkably low (TAVO 1988). Its topographical position on the southern flanks of the Jebel Hamrīn, however, is favorable for the formation of alluvial fans. JASSIM *et al.* (1986) identify this area of the lower terrace partly as Pleistocene-Holocene alluvial fans (west of the Adheim) and partly (east of the river) as Holocene flood plain deposits. Their interpretation seems acceptable if, in former (early-middle Holocene) times, the discharge of the Adheim was greater than at present.[26]

This area, which is also covered by thick irrigation sediments, is comparable from a geomorphological point of view with the Diyala Plains, which we will describe briefly hereafter.

The importance of the study of river terraces has long been recognized as one key for the better understanding of river behavior and the evolution of the whole fluvial system. Terrace formation due to the incision of a river can be attributed to different, not self-exclusive causes : lowering of the base-level, positive tectonic movements, changes in river discharge and changes in the amount and characteristics of the river sediment load. If we can assign a more recent date (Pleistocene-Holocene transition/ early Holocene) to these landforms, only the lowering of the base-level is excluded.[27]

Present landforms in the area between the Adheim River and the Tigris include the bolson [28] and playa of the Shāri saline lake and typical associated eolian deposits. Near the Jebel Hamrīn, a minor fan piedmont (bajada) is present.

West of the present Euphrates, the Western Plateau and the depressions of Abū Dibbīs and Ḥabbānīyah will be briefly discussed later.

The historical geography of the plains adjoining the Lower Diyala River, south of the Jebel Hamrīn, (the *Diyala Plains*) is outlined in the classical work of Adams "*Land behind Baghdad*" (ADAMS 1965). He described the Diyala Plains briefly as *an irregular, fan-shaped alluvium that falls very gently towards the south and was laid down for the most part by waters of the Diyala on their way to join the Tigris River* (ADAMS 1965, 3). Its deposits blend to the south and west with those of the Tigris, and to the east it borders on semi-closed

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[25] Discharge data from TAVO 1988 are from the period 1933-1952, and annual flood discharge is lower than 100 m^3/sec.

[26] BURINGH (1960, 140) identifies buried (virgin) soils 10 meters below the present surface along the Adheim River and ancient river beds. He attributes the '*clay balls*' which can be found at the bottom of former river beds to stream conditions different from those that prevail today (BURINGH 1960, 140).

[27] Remarkably little geomorphological research has been carried out in comparison with the 'archaeological richness' of the Mesopotamian Plain. Published 'geo-science' reports and surveys cover either a local area or a specific topic or are too general ; others are hardly accessible or are unkown to the author. Conclusions in this contribution were based on the available documents listed in the bibliography, and it should be kept in mind that geoarchaeological research in the Mesopotamian Plain is still in its infancy. For an excellent general overview of the *material foundations* of the Mesopotamain flood plain, see chapter I in POTTS 1997.

[28] Here understood as an internally drained (closed) intermontane basin floor which can be of tectonic origin. It includes the central saline lake (playa), the alluvial flats, dunes, and the higher piedmont slopes (FRIEDMAN *et al.* 1992, 516-526).

seasonal swamps and marshes of the fan piedmont zone of the Zagros. The approximate surface of this unit is 7.000 km^2.

The present pattern of the hydrographic (including canals) network of the Diyala Plains south of the Jebel Hamrīn can be described as a radial, dendritic, distributive one, characterized by a topography of alternating levees (irrigation or natural) and basins. Its landscape clearly reflects the millennia-old irrigation cultivation practiced here. The distribution of the old settlements in the Diyala Plains are organized linearly along old watercourses [29] throughout the whole plain. The "*big picture*" of this geomorphic unit can perhaps be schematically described as an alluvial fan overlaid with an irrigation/alluvium fan apron.[30]

The present pattern of the Lower Diyala River is a composite. From the Jebel Hamrīn to its confluence with the Tigris, the total channel length is 171 kilometers, dropping approximately 40 meters (ADAMS 1965, 7). The upper fifty kilometers show a more braided pattern, while the last forty kilometers show a meandering pattern where, under natural conditions, limited overbanking can occur at flood stage.[31] In between, the Diyala is an antecedent, single meandering channel so deeply entrenched [32] that no overbanking occurs even at high flood stage (ADAMS 1965, 7). No significant natural levee formation is associated with the present Diyala River.

From the above it is clear that the present Diyala River [33] is not in harmony with its associated landforms or settlement patterns of the plains. This might suggest a distinct fluvial system with higher discharge during the first occupation periods and a gradual decrease in its water supply.[34]

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29 There is no ancient or modern terminological distinction in Iraq between canals and natural streams (ADAMS, 1965, 8). Nor was there a distinction made in ancient cuneiform sources (S. Cole, personal communication).

30 Within the Diyala Plains this irrigation fan apron can be confirmed from archaeological soundings at Tell Asmar (244) and Tell Khafājah (421) and from a boring at Khashim Wāwi (628) (ADAMS, 1965, 9). The thickness of this apron is on the order of less than 10 meters. Tell Asmar has virgin soil underlying remains of the late fourth millennium BC at a depth of more than 10 m below the present level of the plain adjoining the site (ADAMS, 1965, 9). Tell Khafājah's oldest remains are at 8 m below plain level. Khashim Wāwi, not far from the Nahrawān canal (late third millennium BC), at 7 m below plain level (ADAMS, 1965, 9). These are maximum thickness levels since the sites lay alongside watercourses in use fairly continuously (ADAMS, 1965, 9). The locations of these sites are indicated on Figure 10. For the idea of true fan formation overlaid by alluvial levee formation see ADAMS 1965, 12, and 168, n. 42. SANLAVILLE(1989, 8) also describes this area as an alluvial cone, whose extension has caused the Tigris to shift towards the Euphrates.

31 In contrast with the Euphrates, the Tigris, and the other Tigris tributaries, the discharge of the Diyala is largely a consequence of winter rainfall and not of meltwaters during the late spring (ADAMS 1965, 6). The mean annual discharge is only 161 m^3/sec, with a mean annual flood discharge of 850 m^3/sec (ADAMS 1965, 6). TAVO gives even lower data (TAVO 1988). In many years, due to upstream irrigation off-takes, the Diyala at the confluence with the Tigris had no flow at all during the late summer (ADAMS 1965, 6).

32 This entrenching is, according to ADAMS (1965, 6), due to the gradual rise of the Jebel Hamrīn.

33 The annual sediment load of the Diyala is almost 12.000 m^3 (RZÓSKA 1980, 45).

34 The Kātul-Tāmarrā-Nahrawān irrigation canal reflects the need for an additional supply of (Tigris) irrigation water for the Diyala Plains (ADAMS 1965, 76-79). It was planned (and partly accomplished ?) during the late

2.2. Present Flood Plain of the Euphrates and Tigris

This macro-unit (macro-unit II on Figure 1) is roughly defined as that part [35] of the Lower Mesopotamian Plain where natural flooding of the Tigris and Euphrates can occur or did occur in recent times.[36] It may be subdivided into the meandering river flood plain of the Euphrates, the Tigris, and the Šaṭṭ al-Ġarrāf, [37] the anastomosing flood plain of the Euphrates, and the abandoned [38] flood plains of the central plain [39] and the Šaṭṭ al-Duğailah. It represents nearly 54.000 km^2. The study area is entirely situated in the meandering river flood plain. Before describing the subdivisions, it is perhaps useful to review some flood plain landforms and characteristics and flood plain morphologies.

2.2.1. Flood Plain Landforms and Characteristics

Flood plain landforms in general exhibit a variety of constructional and erosional features produced by river channel behavior and flooding. In fact, heterogeneity is a characteristic of the flood plain environment (ANDERSON *et al.* 1996, 4). The most pertinent flood plain landforms are flood basins (backswamps), braided, anastomosing, and meandering river channel patterns, and eventually channel-bars, natural levees, flood-plain splays, flood gullies, meander belts, channel cut-offs, and channel fills. Inactive or abandoned flood plain units can occur within the active flood plain zone and consist of former flood plains abandoned by the active river channel in the recent past due to processes of river channel migration or avulsion. Only under conditions of extreme discharge are these abandoned flood plains eventually partly flooded. In the Lower Mesopotamian Plain, these abandoned flood plains usually display recent landforms of eolian origin (especially along abandoned stream channels or meander belts) and areas liable to extreme salinization.

Flood plains are continuously constructed and eroded by fluvial processes (MORISAWA 1985, 118).

Sasanian period. The Nahrawān was certainly functional during the early Islamic period (ADAMS 1981, 211). It gradually silted up and was abandoned during the 11th and 12th centuries AD (LE STRANGE 1905, 59).

35 It corresponds approximately with the physiographic units of the flood plains and delta plains of the Tigris and Euphrates as delimited by BURINGH (1960, 122). Here the delta plain unit must be understood in its strict sense as a flood plain characterized by repeated channel bifurcation and divergence, multiple distributary channels, and interdistributary flood basins (SOIL SURVEY STAFF 1997). Note that the soil map of Buringh shows marshy conditions in the now desertic, salt-covered, abandoned flood plain of the Šaṭṭ al-Duğailah (BURINGH 1960, Map 1).

36 See below for more details.

37 At present a canal but it has all the characteristics of a natural levee and was certainly the major river bed of the Tigris during Islamic times. See e.g. LE STRANGE 1900, Map I.

38 This abandonment can be due to a natural process such as avulsion of meander belts or can be anthropogenic.

39 This unit corresponds roughly with the survey area of the Central Flood Plain in "*Heartland of Cities*" (ADAMS 1981).

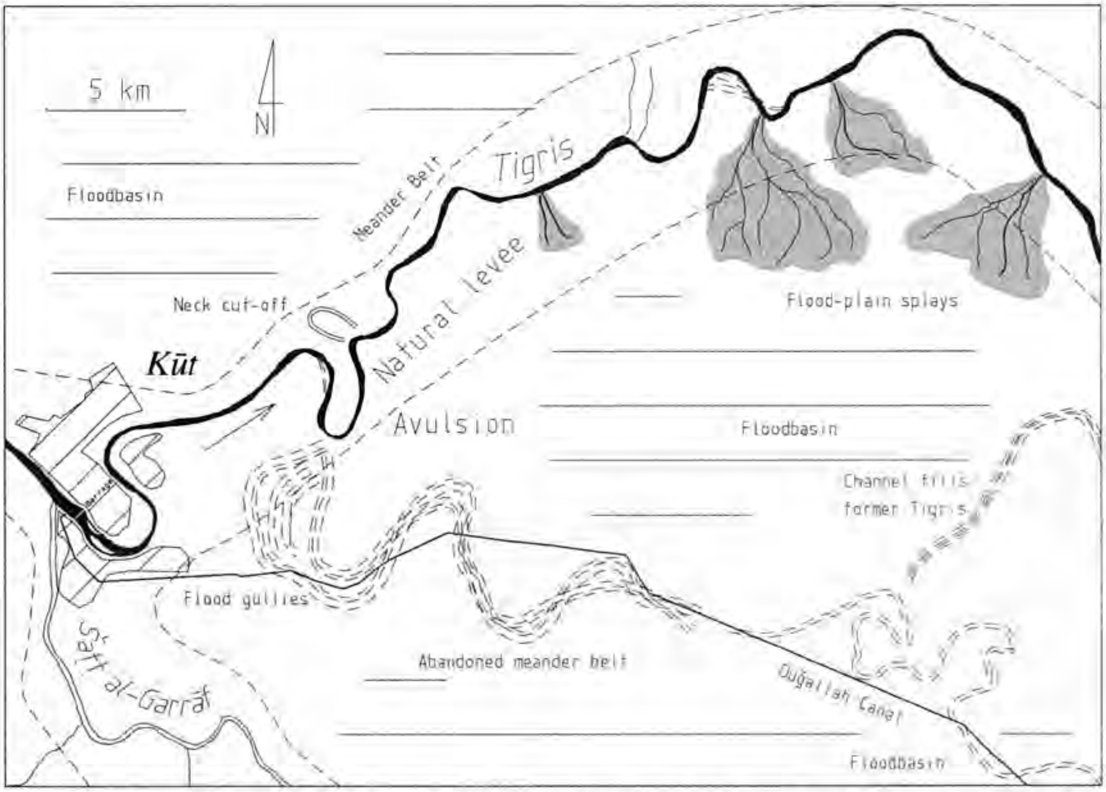

Fig. 2. Flood Plain Processes and Landforms in the Meandering River Flood Plain Zone of the Tigris, Downstream from Kūt. Channel bars have been deposited just downstream from the barrage (completed in 1939 after WILLCOCK's [1917] irrigation proposals) at Kūt due to a decrease in stream power, since a considerable part of the discharge is diverted into the Šaṭṭ al-Garrāf and the present Duğailah canal. The Šaṭṭ al-Garrāf has a prominent natural levee, and presently its water level is maintained by the barrage downstream. Note the extent and scale of the flood-plain splays on the Tigris downstream from the abandoned former Šaṭṭ al-Duğailah (on which the medieval city Wāsiṭ stood). This reach of the Tigris is relatively recent, and the natural levee is still relatively weakly developed so flood-plain splays frequently occurred. Based on SPOT 1991. See also BURINGH 1960, 181, Fig. 92, and 184, Fig. 94.

Flood plain constructional landforms consist of deposits which can be classified in two distinct groups [40] with respect to the position of the active river channel: channel (substratum) deposits and overbank (topstratum) deposits (ALLEN 1965, 128). A third group consists of transitional deposits or channel-fill deposits.

In general channel deposits [41] result from the *lateral accretion* of river sediment load during the sideways migration of channels. These deposits form the meander belt and/or different river channel patterns.

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[40] Near the flood plain boundaries poorly sorted colluvium material may be interlayered with flood plain deposits (MORISAWA 1985, 118).

[41] These deposits are also called 'within-channel' deposits. It should be stressed that these deposits can show an important vertical accretion as well (BROWN 1997, 19). This is certainly the case in some parts of the Mesopotamian flood plain.

Overbank deposits result from *vertical accretion* of suspended load [42] after overbank flow. These deposits lead to the construction of landforms such as natural levees, flood-plain splays, and backswamps or flood basins (ALLEN 1965, 125).

Channel-fills are deposited within abandoned or cut-off channels (ALLEN 1965, 128). The process of abandonment can occur gradually,[43] and aggradation of the channel bed is a net accumulation from alternate scouring during flood stages and deposition during falling stages. Therefore, channel-fills of abandoned channels do not always consist of the coarsest material. The cut-off of channel beds or avulsion process occurs rather quickly ; oxbow-lakes may form, and the coarser channel deposits are overlaid by finer organic material. Channel-fill deposits comprise in quantity only a small part of the flood plain, but they are of great archaeological interest in the Lower Mesopotamian Plain.

Lateral accretion deposits are common to all flood plains, some of which show limited vertical accretion features (ALLEN 1965, 125). Whether significant vertical accretion occurs depends mainly on characteristics of the sediment load and river regime and also on external factors such as changes in river base level and land level due to subsidence (tectonics, compaction) or uplift (tectonics, isostatic) (ALLEN 1965, 125).

Channel deposits usually consist of lag deposits, longitudinal and transverse bars, [44] and point bars. The major type of channel deposits in flood plains of meandering rivers is the point bar [45] (MORISAWA 1985, 119). These deposits will be discussed in more detail below at another scale level.

Channel lag deposits consist of the less mobile and coarsest-grained deposits, and are deposited on the channel beds of scour pools or along the sides of the channel. Their deposition can be associated with the falling discharge from a more competent flood peak (MORISAWA 1985, 118). The texture ranges from gravelly to very coarse sand. They form discontinuous lenticular patches and occupy the lower parts of the channel or point bar

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[42] Different types of river sediment load are defined in the literature based on the mode of transportation but not always in a consistent way. The river sediment load in solution is called the *dissolved load* ; *suspended load* is transported in suspension whereas *bed load* is bed material which moves rolling, sliding, or saltating. Suspended load is most important for flood plain accretion. Suspended load can further be subdivided into *wash load* and *suspended bed load.* The former represents the fraction of the suspended load that is almost in permanent suspension, whereas the latter represents the coarser fraction of the suspended load that is only suspended above certain flow velocities (BROWN 1997, 323).

[43] During floods the water may flow over the point bar and form a little channel, or *chute*. This may be widened by further erosion to become the main channel. This process is called chute cut-off. The sinuosity may also become so high that erosion cuts a channel through a narrow neck (neck cut-off), making a straight course to a meander of the river. This whole meander will then become an inactive channel, which will gradually fill with sediments (*abandoned channel fill*) (BJØRLYKKE, 1989, 72).

[44] Many other types of within-channel bars are differentiated (see e.g. BROWN 1997, 20-21). Point bars and longitudinal bars are the dominant types in the present Mesopotamian flood plain rivers.

[45] In the strict sense point bars are limited to the active channel bed deposits on the inner or convex side of a river meander. When such a meander migrates laterally, former point bars may become inactive channel deposits and are usually wave-like in cross-section (ridge and swale topography) and curved in planform. Such inactive deposits, associated with the laterally migrating channel, are also called scroll-bars. Here, however, we will apply the term point bar in a broader sense.

sequence. They indicate the base of the channel, and in ancient records they could indicate the base of the former channel.

Longitudinal bars are diamond-shaped and elongated with the alignment of their long axis parallel to the stream flow (MORISAWA 1985, 118). Their texture grades downstream into finer particles. The upstream ends and sides of these bars are steep. They usually occur in groups, are very mobile, and their configurations change with fluctuations in discharge (MORISAWA 1985, 119). Transverse bars are tabular in shape and lie across the path of the stream flow. They are thought to build up at low flow in what had formerly been a depression in the river bed (MORISAWA 1985, 119).

Overbank flooding, mainly responsible for the vertical accretion of the flood plains, causes deposition of a wedge of sediments thinning away from the channel edge and with a decrease in particle size towards the flood basin. It is generally agreed that lateral accretion is dominant over vertical accretion in flood plain construction (MORISAWA 1985, 121). Since sediment-load discharge peaks before water discharge, overbank flooding generally carries relatively less sediment. This also may favor the vertical accretion of natural levees and channel bed in respect to the flood basins. The flooding of a river can occur through two completely different processes. The first occurs by way of a sheet-type overflow (overbanking/overtopping of the river over long distances along the levee), and the second by way of distinct 'breakthrough channels' [46] cutting across the levees (flood-plain splays).

These splays develop their own channel pattern and system. Flood-plain splays (crevasses) have coarser deposits, spread out in a fan-shaped lobe on the flood plain where excess water leaves the river channel through restricted low sections or breaks in the natural levees (Figure 2). Flood-plain splays can extend several kilometers across the levees into the flood basins. Occasionally, crevasse channels may divert the main river discharge, causing a change in the river course. The sudden abandonment of part or all of a channel course is called avulsion.[47] As a result, levee deposits are made up of numerous interfingering and overlapping lenses of sandy to loamy material.

The formation of natural levees will be covered below in more detail.

Flood plain erosional landforms are mainly the result of short-term river channel migration and river behavior. In flood, the river may break through its levee and form a crevasse (see above). Eventually, when levees are steeper, sheet erosion on the flood plain during a flood may take place (MORISAWA 1985, 121). Other erosional landforms can consist of flood gullies, bank and flood plain boundary erosional landforms, or relict landforms now being eroded within the active flood plain zone. Geomorphic responses of the fluvial system to medium/long-term changes of external factors (changing climates, devegetation [48] and sediment supply changes, base level changes, neotectonics, etc.) may

[46] Usually the flood path passes over the convex side of the river meander, and a flood channel or chute can develop (See e.g. SELLIN and WILLETTS 1996, 282, Fig. 8.25). After several floods, this chute can become the main channel and a chute cut-off is formed.

[47] REINECK and SINGH 1973, 246.

[48] The term in question refers to a variety of processes of human impact on the landscape (BUTZER 1982, 124).

result in increased stream power and eventually the removal or modification of former flood plain constructional landforms.

Flood plain landforms and deposits are now relatively well described from a sedimentological viewpoint.[49] However, research towards a better understanding [50] of flood plain processes and meandering river evolution are, relatively speaking, in their infancy (ANDERSON *et al.* 1996, 9).

Most research on flood plain landforms focuses on river channel patterns. In nature there exits a wide spectrum of river channel patterns,[51] and they are a reflection of short-term channel adjustment to channel gradient and channel cross-section or of medium-term changes in water and sediment discharge. Indeed, channel patterns are strongly controlled by the amount of sediment load and its characteristics, and by the amount and nature of discharge (REINECK and SINGH, 1973, 225).

Various types of river channel patterns have been described and/or defined at different scales of measurements. Different classifications have been proposed, based on different natural river controls (e.g. hydrological or sedimentary processes, relationship to bed and bank characteristics) or descriptive parameters (e.g. degree and character of sinuosity, braiding or anabranching, morphology of network or channel, stability of channels) and serving different purposes or goals. All this reflects the wide range of variation and intergradations among the spectrum of natural channel patterns. Indeed, it should be stressed that stream channel patterns are thought to form a morphological continuum (ALABYAN *et al.* 1998, 467). However, main river channel patterns are commonly classified into meandering, braided, straight, and anastomosing on the basis of stream morphology (BOGGS 1995, 306). These channel patterns may reflect stability over at least short time scales (10^1 - 10^2 years). There has been a wealth of studies of the influence upon channel patterns of river and valley slope, flow regime, sediment load (amount and size range), erosional and depositional history (e.g. tectonic deformation, long-term aggradation or entrenchment, environmental changes), and local physiography. Still there are no universal criteria for predicting planform type or even universal agreement on leading causative factors (HOWARD 1996, 16).

Since there is a morphological continuum of river channel patterns, these patterns may change over a certain period of time. The general process of changes of river morphology is

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49 See the classical review of ALLEN 1965 ; for more recent views, see e.g. FRIEDMAN *et al.* 1992.

50 In the complex space-time processes of flood plain environment, there are great sedimentological and hydraulic variabilities. Both can be structured or apparently random. Frequently only weak relationships exist between the hydraulics (flow rates, turbulence, etc.), chemical (viscosity, etc.), sedimentological (sediment load amount and characteristics, sediment supply, transport rates, etc.) and geomorphological (bank environments, river bed form, vegetation, relict landforms, time, erosion, etc.) controls of flood plain evolution. By far, sedimentological heterogeneity is better understood than hydraulic and chemical heterogeneity (ANDERSON *et al.* 1996, 5).

51 River channel patterns deal with the configuration of river segments in planform.

known as river metamorphosis [52] and was first introduced by SCHUMM (1972, 395-421, and 1977, 159-171). Typical examples of river metamorphosis are the transition from braided river channel patterns to meandering ones during Late Pleistocene times (NÜTZEL 1979, 228). It is our working hypothesis that such a river metamorphosis took place in our study area after the early-middle Holocene, mainly due to changes in discharge, sediment-load supply, and/or river bank vegetation.

2.2.2. *Flood Plain Morphology*

Flood plains are commonly classified by the associated river channel pattern (LEWIN 1978, 420, Fig. 4). NANSON and CROKE (1992) classified flood plains by a combination of sedimentological characteristics, formation processes, and stream power per unit channel width. Of the fifteen flood plain types they recognized, two are of particular interest for us : the medium energy flood plains with non-cohesive sediments and meandering channels, and the low energy cohesive sediment flood plains of anastomosing channels.

Meandering river flood plains are formed by lateral channel migration and flooding. The flood plain sediments are dominated by coarse textured point bars and channel bars and finer textured overbank flood deposits. The river channel planform forms a meander belt. If there is vertical aggradation, a natural levee may be formed. Levees are embankments alongside the river channel. They rise above the level of the adjacent flood plain level, but are wider in relation to their height. They encourage lake and swamp formation in the flood basins, since not all water is able to return to the main channel when floods subside. Levees are formed through successive flooding and deposition of sediments. Deposition is greatest nearest the river, because, as the water floods out of the main channel, its speed is immediately checked by friction with the banks, with the heavier sediments being deposited first.[53] Along rivers where the levees have been raised by man to prevent floods there is a tendency to deposit along their beds. The eventual effect of this may cause the rivers to flow between their levees at a level that is higher than their flood plains.

If the input controls of a fluvial system and the channel bed position remain constant both in planform and vertical dimension, we might expect that the formation of these natural levees and the flood basin accretion would tend, in the short-term, towards a self-limiting system, as there would be a progressive decrease in overbank deposition as the levees are aggraded vertically.[54] Characteristic for large rivers in semi-arid climates,[55] the vertical

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52 River metamorphosis in general refers to the change of river channel morphology that can occur when changes of discharge and sediment supply exceed a threshold condition. These changes in river channel morphology can be expressed in single or combined adjustments of river channel cross-section, river channel pattern, or even the whole drainage network.

53 In general flow velocities during floods increase due to a combined effect of an increasing hydraulic radius (ratio of channel cross-section to wetted perimeter) and a decreasing roughness factor (Manning's n factor) at bankfull stages (EASTERBROOK 1993, 98 ; PETTS and FOSTER 1985, 100). Manning's n factor increases rapidly when the flow spreads onto the flood plain.

54 WOLMAN and LEOPOLD 1957 (cited in BROWN 1997, 23). As one might expect, the limits of natural levee accretion will be related to the level of the mean annual bankfull stage. See also ADAMS 1965, 8.

dimensions of the channel bed in short-term periods remain constant, since during high flow the channel bed tends to scour [56] and fill again at low flow (LEOPOLD *et al.* 1992, 229). Only when there is a net vertical channel bed aggradation [57] will continuous levee formation occur over longer time periods. Such aggradation can be initiated either by changes in sediment load-discharge relationships, [58] calling for an increase in river gradient, or by the raising of the base level (EASTERBROOK 1993, 129). However, input controls vary continuously, and as river channels migrate, limited net flood plain accretion will occur when deposition takes place on former flood basin materials.

Anastomosing river flood plains have a very low gradient and are commonly straight to weakly meandering with separated multiple channels. Channel meandering is weak due to the low stream power and the cohesive [59] banks. Low gradient flood plains are usually associated with an aggradational regime or flood plain sinking (HOWARD 1996, 49). The aggradational regime and relative channel stability favor natural levee formation. Anastomosing generally develops due to avulsion at breaches in the natural levee. Non-active zones of the flood plain are usually swampy or occupied by shallow lakes (HOWARD 1996, 49). In general, these anastomosing rivers are characteristic of areas with very low downriver slopes and are common in swamps and marshes, on delta tops, and where valley floors are adjusted to a local base level (COLLINSON, 1986, 41).

Figure 3 summarizes the present river patterns of the Mesopotamian flood plain in relation to their main characteristics. As is evident from this figure anastomosing river patterns are more stable and typical for low gradients (slopes). Meandering river patterns develop at steeper gradients and are less stable. Eventually, as river systems adjust their gradients, transitions from one pattern to another can occur.

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55 LEOPOLD *et al.* (1992) used data from the Colorado River, a river, according the Adams, comparable with the Euphrates (ADAMS 1981, 1).

56 Channel scour and fill are used to define channel bed cutting and sedimentation during relatively short periods of time, whereas degradation or aggradation apply to processes that occur over longer time periods (LEOPOLD *et al.* 1992, 227).

57 BROWN (1997, 25, and reference therein) demonstrates that Holocene flood plain accretion can occur with no change in channel bed height when river channel patterns change from braided to single-channel meandering ones. According to this so-called stable-bed aggrading-banks model, the bankfull capacity of the channel cross-section is increased by the vertical aggradation of the riverbanks, when the discharges of multiple channels have to flow through one channel (BROWN 1997, 24). Deposition, however, seems to be triggered by a net decrease in discharge and an increase in fine sediment supply due to land-use changes, and the constant channel bed height can be the result of increased stream power of the single channel.

58 In general one might expect that changes in discharge occur over the medium time-scale, whereas changes in sediment load can occur in a shorter time span. The latter influences the aggradation (siltation) of the channels due to deforestation, for example.

59 Cohesive banks are bedrock or silt-clay banks ; non-cohesive banks are sand or coarser (KNIGHTON 1984, 86). Also vegetation on the banks increases bank stability and resistance.

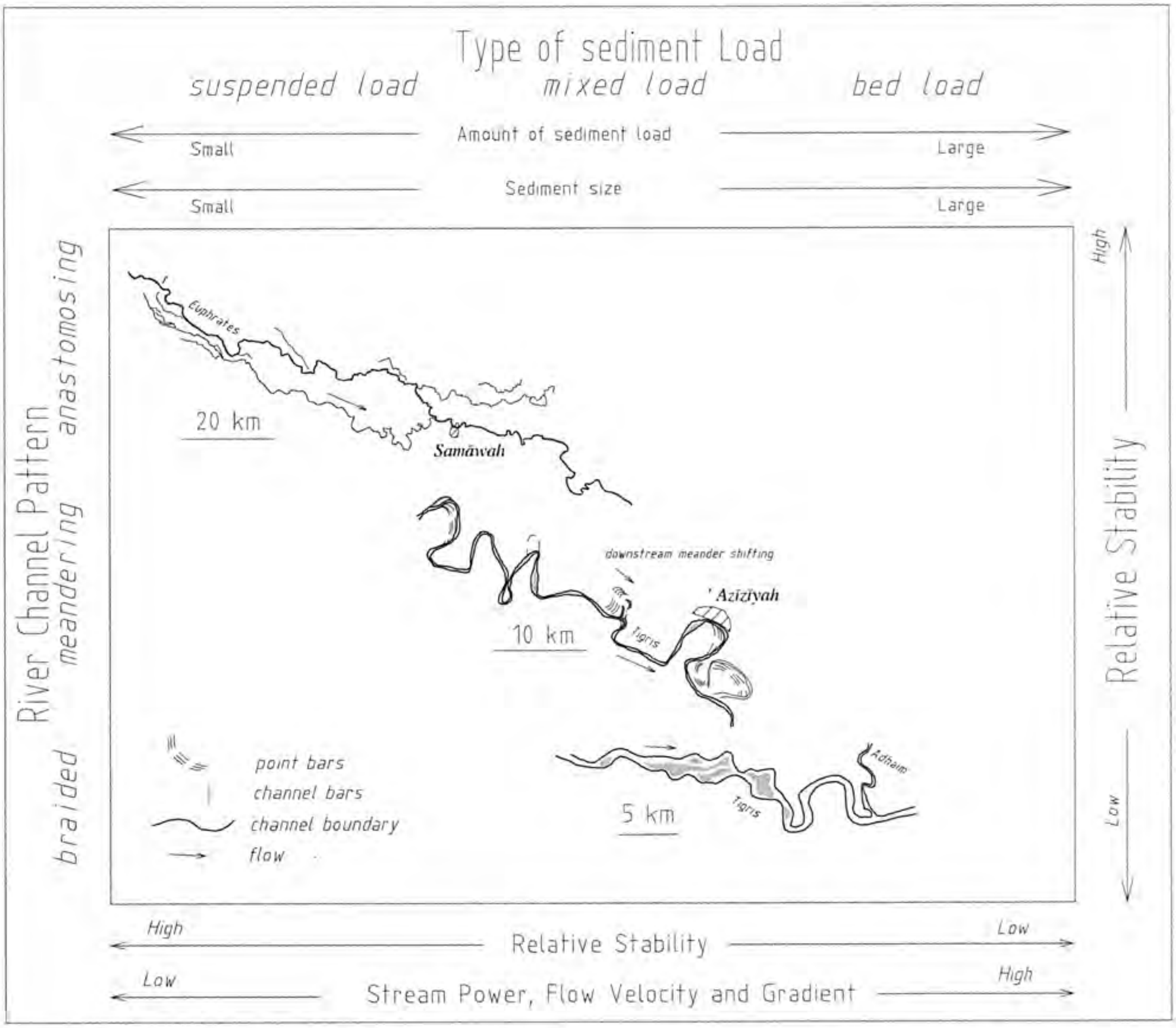

Fig. 3. Present Main River Patterns in the Mesopotamian Flood Plain and Main Characteristics (modified after SCHUMM in GOUDIE (Ed.) 1995, 87).

2.2.3. Flood Plain Evolution

Geomorphological research of flood plains is a rather young discipline. More attention has been directed to the relation of flood plain landforms to river channel processes and less to the evolution of flood plains themselves.[60] The study of flood plain evolution is in part a historical science, and as such, it has much in common with geoarchaeology. An

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60 On the formation of flood plains, see LEWIN 1978 ; NANSON and CROOKE 1992. For flood plain processes, see ANDERSON *et al.* 1996. For a geo-archaeological context, see the excellent work of BROWN 1997, and on flood plain palaeoenvironments, see BROWN 1996.

understanding of its evolution is essential for the interpretation of archaeological sites in alluvial contexts and for insights into human-environment relationships (BROWN 1997, 17).

In general lateral migration of channel belts and vertical accretion (overbanking) are the main processes of flood plain formation. However, their relative importance in flood plain evolution and rates may change over time and surely are flood plain specific. Whether flood plains evolve as suspended-sediment sinks or as superimposed natural levees, depends on many local and regional factors.

BUTZER (1982, 134) describes several cut-and-fill cycles in flood plain evolution and attributes them to geomorphic responses to changes in soil erosion in the flood plain periphery. Such accelerated soil erosion causes [61] an increase in sediment supply, resulting in the development of a higher flood plain along rivers or rapid channel filling, and the possible switch from a meandering pattern to an unstable braided system (BUTZER 1982, 134). When the sediment supply is drastically reduced ... *this normally favors new readjustments in hydrological processes and floodplain geometry, with stream entrenchment that leaves the floodplain as a nonfunctional 'terrace' several meters above a new and narrower floodplain...* (BUTZER 1982, 135).

River channel patterns, which are ultimately responsible for flood plain evolution, vary over time as well. A present meandering river may migrate laterally over relict flood plains deposited by a former anastomosing channel of the very same river. And, as we will discuss later, the causes for such changes need not always be climatically induced and can occur within short-term spans.

Flood plain geomorphology and the archaeology of the flood plain in Mesopotamia have their reciprocal importance, not at all fully exploited yet. Flood plain geomorphology can give us some insight into the processes of river channel aggradation (or natural levee formation) and flood plain accumulation (or flood plain topographical evolution), whereas archaeology can give us a high resolution time frame for these processes, which is often lacking in pure geomorphological research.

2.2.4. The Subdivisions of the Flood Plain of the Euphrates and Tigris

More description of the meandering river flood plain of the Euphrates and the Tigris (the study area) will be given below when discussing the study area at meso-scale.

The area between the present Šaṭṭ al-Ġarrāf and the Tigris (approximately 7.000 km^2), which represents an abandoned flood plain, is at present a large salt-covered desert plain with intense eolian activity. It has never been the subject of even an extensive geo-archaeological study and still awaits topographic surveying (ADAMS 1981, 15, 251). It is clear, however, from satellite interpretations, that this area at one time witnessed intensive irrigation practices and occupation along different bifurcating channels south of Wāsiṭ. It is

[61] According to BUTZER (1982, 129), such accelerated soil erosion can, within a few generations or even a few years, change landforms and move more soil than can millennia of environmental change.

known to have once been a major Islamic reclamation area (ADAMS 1981, 218). The extensive marshes (Haur as-Sa'dīyah) that existed west of the present Tigris in this area and were fed supplementarily since the 1950s by the Musandag escape downstream from Kūt, are dramatically shrinking.[62]

The morphology of the abandoned[63] flood plains of the central plain and the areas around Uruk[64] and Ur are described in detail by Adams, Nissen, and Wright (ADAMS 1981, ADAMS and NISSEN 1972, WRIGHT in ADAMS and NISSEN 1972).

The topography of the central flood plain as a whole is a result of the combined effect of natural and anthropogenic processes. These processes ... *account for an ordered sequence of westward riverine movement, for intercalated networks of levees and depressions, and for shifting zones of settlement and cultivation. Seen from a distance, or over progressively more inclusive intervals of time, the dominant impression is one of broad, systemic change* (ADAMS 1981, 22).

Adams gives an overview of the major watercourse succession patterns for the central flood plains. Apart from other alternative views that he gives about these succession patterns, the general picture he proposes may be understood from the following sentences: *... it appears that a strikingly different general arrangement of watercourses existed at the time human settlements first became widespread in the early fourth millennium. The Tigris and Euphrates did not remain distinct, as they do today, but were joined near the head of the alluvium. At that point, however, they did not form a single united stream comparable to the Shatt al-Arab at the foot of the modern alluvium. Instead, they diverged once more into an uncertain but probably considerable number of channels that together may have constituted a shifting, bifurcating, and rejoining combination of an anastomosing pattern and an alluvial fan as they crossed the lower Mesopotamian plain toward a number of separate points of outflow into the Gulf. After the fourth millennium the Tigris passes largely out of our ken for an extended period. Diverted farther eastward by the buildup of Euphrates sediments, it may have shifted abruptly into its modern, single-channel form in approximately its present position. A course even farther to the northeast is also possible, followed by a reverse movement into its present position as sediments from the Diyala alluvial fan accumulated that would divert it southward once more* (ADAMS 1981, 17-18).

This abandoned flood plain is now subject to intense eolian activity. Dunes and deflation basins are prominent in this area characterized by rapid changes.

The Šaṭṭ al-Ġarrāf is situated on a natural levee, as it was once a major branch of the Tigris river system.[65] It gradually silted up, and since the 16th century AD, the present Tigris

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62 Compare DE VAUMAS 1964, Plate XXI, and RZÓSKA 1980, 46, Fig. 17 (Rzóska confuses the Ġarrāf canal here with the Musandag escape).

63 It is thought here that this abandonment (of the Euphrates) took place at the end of the 18th century BC (ARMSTRONG and BRANDT 1994, 261).

64 For more recent geomorphological research in the Larsa-'Oueili region, see GEYER and SANLAVILLE 1996.

course has been the main river (BURINGH 1960, 182). At present it is possible to irrigate again from it, since its flow is maintained by the barrage at Kūt. On satellite images the importance of this natural levee can be estimated on the basis of salinization strips at the top convexivity of the levee on both sides of the Šaṭṭ al-Ġarrāf.

Below Ḥillah the present pattern of the Euphrates changes into an anastomosing river. Figure 4 depicts a detail of the present situation east of al-Kūfa.

2.3. Fluviolacustrine-Deltaic Complex of the Euphrates-Tigris-Karūn

This macro-unit (macro-unit III on Figure 1) is a very complex, variable,[66] and active geomorphic unit[67] (SANLAVILLE 1989, 11). Different sedimentary subenvironments and processes interact and form — together with external short-term factors[68] such as subsidence, postdepositional compaction, liquefaction and neotectonics — a variety of landforms, including reed and dried marshes, fresh and brackish water lakes, inland delta-lobes,[69] broad natural levees of the Tigris, the Euphrates, and the Šaṭṭ al-ʿArab, the inland deltas of the Karūn and the Karkheh, and the wide marine[70] deltaic system of the Šaṭṭ al-ʿArab.

This is mainly a zone of deposition[71] of allochtonous suspended load (silty clays) of the former rivers, dust (silt) fall-out, and autochtonous biochemical and chemical sediments (AQRAWI and EVANS 1994, 757). The relative importance of the two major (i.e. fluviatile and eolian) sources is difficult to assess since the sediments are texturally, mineralogically,

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65 It is thought that this Tigris course was mainly responsible for the creation of the *Great Swamp* between al-Kūfa and Baṣra at the end of the 5th century AD (PLAZIAT and SANLAVILLE 1991, 342).

66 Due to modern, large-scale engineering work, this world-unique, extensive fluviolacustrine-marsh environment is changing dramatically. For satellite images of the environmental impact of waterworks: see e.g. *http://edcwww.cr.usgs.gov/earthshots/slow/Iraq/Iraq* and references therein (last revision 02/14/99).

67 There is, surprisingly for such an important delta-complex, limited published work (AQRAWI and EVANS 1994, 755). For a more detailed overview, see SANLAVILLE 1989; BALTZER and PURSER 1990; AQRAWI and EVANS 1994.

68 On the long-term time scale, this unit is, of course, influenced in the south by the Holocene transgression and the gradual progradation of the delta complex. The present shore-line was approximately attained around 6.000 BP. The competition between eustatic sea level fluctuations during the last 6.000 years, vertical movements (either local or regional and due to different processes), and deposition probably created intermixed sedimentary subenvironments, which can only be disentangled by way of detailed field investigations. On the relative importance of processes forming the Mesopotamian delta, LEES and FALCON (1952) emphasized the importance of tectonism and subsidence, whereas LARSEN (1975) gave more importance to eustatic movements.

69 Inland delta-lobes are fluvially (fresh water) dominated continental types with high sediment input. They are usually formed by channel avulsion or parallel distributaries and can have a typical fern-frond shape. Large flooded areas are gradually being silted up due to rice cultivation, described by BURINGH (1960, 187) as probably the oldest system of land reclamation in the world.

70 This littoral deltaic system is dominated by strong tidal conditions and comprises large estuarine sabkhas along the waterways and peritidal flats.

71 South of the line al-Kūt - Ḥilla, representing the delta plain according to BURINGH (1960, 123), sedimentation of suspended load is already important (SANLAVILLE 1989, 8 and 12).

and geochemically very similar (AQRAWI and EVANS 1994, 773). There is no textural difference between the suspended loads of the Tigris and the Euphrates, since both are within the silty-clay to silty-clay-loam classes (AQRAWI and EVANS 1994, 765).

AQRAWI and EVANS (1994, 758) investigated the recent sedimentation in the lake and marsh area (Ahwar sediments) based on subsurface (< 1m) core samples taken within the triangle of Baṣra, Nasirīyah, and Qūrna. For most of the studied profiles, they differentiated three distinct sedimentary units : an upper, very modern,[72] organic-rich sandy silt unit, an intermediate shelly unit of fresh/brackish fauna, and a basal clay-rich laminated unit with a brackish/marine microfauna (AQRAWI and EVANS 1994, 772). The first two units are interpreted as modern [73] lacustrine-marsh deposits, which do not exceed 50 cm in thickness and cover the basal unit. This latter sedimentary unit must have been formed when the central part of their study area was subjected to more marine conditions (brackish-marine near-shore or lagoonal environments), a condition that had persisted until about 3.000 BP (AQRAWI and EVANS 1994, 772). They concluded that *since 3.000 years BP the present day freshwater environment of the area has persisted without any major changes* (AQRAWI and EVANS 1994, 773).

In spite of the thick reed beds in the marshy zone, there is no evidence of modern organic preservation, as the organic matter is very efficiently decomposed (AQRAWI and EVANS 1994, 775). However, Aqrawi described organic-rich sediments within Holocene bore-hole sequences (AQRAWI 1997). He attributed the preservation of this organic-matter to high rates of sedimentation, particularly in the early-middle Holocene. This evidence of organic material (*Phragmites* sp. and *Typha* sp.) predates [74] the main middle Holocene brackish/marine transgressive sediments [75] (AQRAWI 1997, 69).

The Karūn and the Karkheh Rivers form two coalescent alluvial fans [76] upstream, which are still very active (SANLAVILLE 1989, 10). At present the Karkheh River ends in the marshes east of ʾAmāra. During the Middle Ages, however, the Karkheh was once a tributary of the Karūn (SANLAVILLE 1989, 10). Presently the Karūn is mainly responsible for the discharge and sediment supply [77] of the Šaṭṭ al-ʿArab (SANLAVILLE 1989, 11).

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72 < 400 years BP (AQRAWI and EVANS 1994, 774).

73 Radiocarbon analysis of near-surface shells taken from within this area shows a date for the modern lacustrine-marsh complex that does not exceed 3.000 years and usually does not exceed 2.500 years BP (AQRAWI and EVANS 1994, 773).

74 6.000 to 9.000 BP depending on their location (AQRAWI 1997).

75 These middle Holocene brackish/marine sediments are attributed to the transgressive Hammar Formation (AQRAWI 1997).

76 Kirkby also describes a major (incised) alluvial fan of the Karūn south of Ahvāz (KIRKBY 1977, 265, Fig. 101). According to BALTZER and PURSER (1990, 188, Fig. 9) a better morphological description for these sedimentary environments at present would be delta lobes and levees of the Karūn and Karkheh. The Karūn is an antecedent river on a large alluvial fan and smaller channels behave as deltaic distributaries leading to marshes both on the north and south sides of the alluvial fan (BALTZER and PURSER 1990, 179 and 188). This alluvial fan can probably be interpreted as a relict feature.

77 These sediments are mainly fine sands and silts. Of the total discharge of the Šaṭṭ al-ʿArab, estimated at 27×10^9 m^3/year, 25×10^9 m^3 is delivered by the Karūn (SANLAVILLE 1989, 11). Water and sediment supply of the Tigris and Euphrates towards the Gulf is negligible.

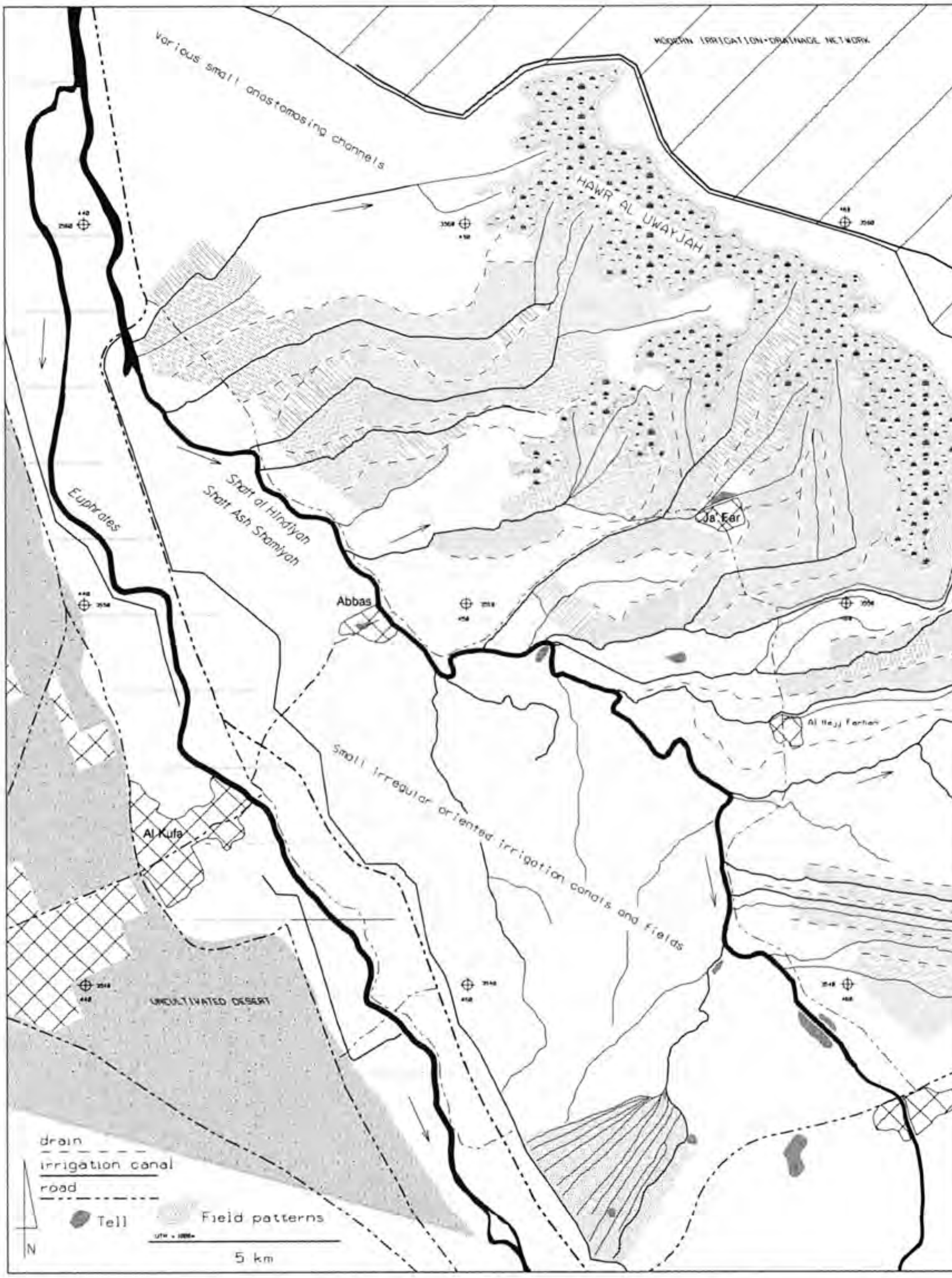

Fig. 4. The Anastomosing River Flood Plain of the Euphrates, East of al-Kūfa. Traditional irrigation practices are still used. Note the alternations of small irrigation and drainage canals towards the central depression of the Haur. Based on SPOT panchromatic 12/1990.

Another alluvial fan, smaller in extent but perhaps illustrative of the evolution of other alluvial fan landforms in the area, is the relict alluvial fan of the Fuka river, 50 km northeast of ʾAmāra (Figure 1). This fan is no longer built up by active aggradation but shows instead active erosion and incision of shallow, radially distributed gullies. The former fan-constructional river now cuts a deep (> 10m) transverse gully on the northern margin of the fan and reaches the depression between the Fuka fan and the adjacent fan before eventually discharging into the marshes east of ʾAmāra (BALTZER and PURSER 1990, 189). There is no significant new fan development, and this leads Baltzer and Purser to suggest that either a reduced rate of supply or a comparatively recent change in this river course [78] is responsible for the present landform evolution. However, taking into account the deeply incised gully and the perennial character of the river, a reduced rate of supply seems more plausible. Again, such landforms suggest a former period of higher discharge and sediment supply followed by the present period of reduced activity.

2.4. The Gulf

The global importance of the late Quaternary geomorphological history of the Gulf for the Lower Mesopotamian Plain is twofold : it is the zone where the Holocene transgression is manifested and where the upstream erosional/depositional changes in the behavior of the rivers should be reflected in the downstream depositional records. The change in sea level affected the flow and sedimentation of the Tigris and Euphrates Rivers far inland on the Mesopotamian plain (HOLE 1994, 130, Fig. 6). Therefore, these changes and the associated Holocene sedimentation and sedimentation rates in the southern part of the Mesopotamian Plain, in the Gulf, and on the Mesopotamian Shallow Shelf in particular, should be considered.

The local importance of the late Quaternary geomorphological history is displayed in shoreline reconstructions [79] of the head of the Gulf. Holocene shoreline reconstructions [80] within an active lacustrine-deltaic environment are extremely difficult. Not only are local depositional and erosional rates uncertain,[81] but so are even general relative sea-level rises

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78 BALTZER and PURSER (1990, 189) suggest the recent changing of the course as most likely.

79 On the evolution of the southern Mesopotamian Plain during the last millennia, see SANLAVILLE 1989. LAMBECK (1996) reviewed the shoreline reconstructions for the Gulf. For a more detailed discussion of the progradation of the Tigris and Euphrates delta, see also POTTS 1997, 30-39.

80 A sea that rises relative to the land, for whatever combination of reasons, is called a submergence, while it is called an emergence if the sea falls relative to the land. Even without a relative change in the vertical direction of sea levels, the shoreline can be shifted inland by marine erosion (retrogression) or seaward by prograding sediment (depositional regression) (FRIEDMAN *et al.* 1992, 196). According to e.g. LARSEN (1975, 53) at least 150 to 180 km of such progradation must have occurred during the last 5.000 years.

81 Holocene sedimentation rates have been calculated for the fluviolacustrine-deltaic deposits (AQRAWI 1995). Excluding near-surface overburden compaction, these rates have been estimated to be between 1 and 1.8 mm/year throughout the Holocene from 8.400 BP until 3.000 BP. Taking into account these compaction corrections, the rates increased to 1.3 and 2.2 mm/year. During the later stage of the Holocene, rates of 0.4 mm/year were not exceeded.

or fluctuations,[82] being in their turn a combination of glacio-eustatic, isostatic, local subsidence, and neotectonic contributions that are far from completely documented in Lower Mesopotamia.

2.4.1. Sea Level Changes

Changes in sea levels affect the changes of the base level of the longitudinal river profiles. Such a longitudinal profile represents a balance of capacity and competence in the amount and type of sediment load that has to be transported with a given discharge, and slope adjustments are made along with the mutual interaction of other channel characteristics (e.g. cross-section, river pattern, etc.) (MORISAWA 1985, 84). However, adjustments are usually made by the river in terms of scour or fill in the channel bed to lower or raise its gradient (MORISAWA 1985, 84).

The generalized profile of most rivers shows a concave-upward profile [83] so that slope decreases in a downstream direction (MORISAWA 1985, 85). Such a profile is explained by the downstream increase of discharge enabling the sediment load to be transported on progressively lower slopes. Excessively concave profiles are associated with rivers which have extended over Quaternary estuarine sediments as the sea-level retreated (PETTS and FOSTER 1984, 143). The lowering of the base level creates a knickpoint that migrates upstream (BROWN 1997, 33). Such a knickpoint marks the maximum headward erosion of a new erosion cycle that grades to a new and lower base level. Possibly such a knickpoint may be located on the Euphrates near Hīt, and the formation of the terraces of Fallūǧah and Iskandarīyah as erosion remnants might be associated with this erosion cycle (Figure 10).

However, as is often the case in semi-arid and arid regions or with rivers exhibiting a downstream increase of the ratio of sediment load to discharge, some rivers have convex profiles (MORISAWA 1985, 85). More generally, such convex profiles are due to downstream decrease in discharge, for whatever reason (evaporation, flow diversions, etc.), and reflect downstream aggradation during rare flood discharges (PETTS and FOSTER 1984, 144). Longitudinal profiles are rarely smooth since they may contain evidence of past events (KNIGHTON 1984, 148).

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82 It is a gross oversimplification, for the Pleistocene period, to equate the highest sea levels with the warmest climates and the lowest sea levels with the coldest climates. However, climate and sea level are, of course, ultimately related, and climatically caused sea-level changes can take place rapidly. During the Holocene, sea-level rises are estimated to have been on the order of 100 m in 6.500 years (Holocene submergence is known in Europe as the Flandrian transgression). The sea-level curve for the Holocene in the Gulf displays a set of oscillations (small rises and drops, different rates) similar to the so-called Fairbridge view of the Flandrian transgression (FRIEDMAN *et al.* 1992, 196). The displacement of the shorelines of the Gulf were, at times, very rapid (SARNTHEIN 1972, 260). These rates during the Holocene submergence are estimated at 100 - 120 m/year between 15.000 BP and 12.000 BP (SARNTHEIN 1972, 262). If we omit one stillstand in the submergence (at -30m depth), we can deduce a rate of 50 m/year during the period 12.000 BP and 6.000 BP (corresponding with a sea-level rise of -65 to +2). Around 6.000 BP, the Gulf attained its present coast line in the north and east (SARNTHEIN 1972, 262).

83 See the generalized river profiles of the Euphrates and the Tigris in GIBSON 1972, 21.

Since the Holocene transgression the end points of the base level have moved several hundreds of kilometers towards the present position of the head of the Gulf. River adjustments towards this new longitudinal profile are complex, but, very generally speaking, must have caused renewed upstream river incision (headward erosion) and downstream aggradation. The former is responsible for river terrace formations in the upstream valleys and the latter for the net accretion of the Lower Mesopotamian Plain. The transitional zone between the upstream incision and downstream aggradation is a zone where the behavior of the rivers is highly susceptible to changes, and it migrates gradually upstream. This transitional zone is perhaps located in the region of our study area.

Unfortunately we have no precise topographical data to represent anything other than generalized longitudinal profiles [84] for the Twin Rivers. Even if we had such detailed longitudinal profiles, interpretations based on river gradients must incorporate data on channel cross-sections, discharge, bed morphology, and the amount and type of sediment load. Surely some of these factors changed interdependently or independently during the period of the Holocene.

Fluvial geomorphic responses to sea level changes are immensely complicated and still poorly understood for various reasons. Certainly the intensive character of such responses, which would have destroyed or modified much of the evidence, is an important one, as are uncertainties about rates of sea level changes and the adjustability of channel gradients. Furthermore, during the time-span of the Holocene transgression, other environmental changes caused variations in the input variables (e.g. discharge, sediment load supply, etc.) of the fluvial system. The morphological consequences of these changes also interfere.

2.4.2. Sedimentation History of the Gulf

In general it seems that until 14.000 BP the Gulf was free of marine influences and can be seen as a dry, flat valley of the palaeo-Šaṭṭ al-ʿArab (SARNTHEIN 1972, 245). The shorelines [85] at the Mesopotamian Shelf zone of the Gulf were reached around 6.000 BP and sea-levels fluctuated a few meters above the present level, probably inundating low-lying areas of South Mesopotamia (SANLAVILLE 1989, 14). The Gulf attained its present configuration about 1.000 BP as a result of the construction of the Tigris-Euphrates-Karūn delta, tectonism, and aggradation along its Arabian and Iranian flanks (UCHUPI *et al.* 1996, 237).

The bottom of the Gulf forms a smooth longitudinal profile [86] which can be extended landwards to the present Mesopotamian Plain.

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[84] Surely the longitudinal profiles would be compound profiles with concave segments separated by convexities.

[85] See DALONGEVILLE and SANLAVILLE 1987, 583, for a synthetic sea-level curve of the last 8.000 years.

[86] SARNTHEIN 1972, 250, Fig. 3. SARNTHEIN (1972, 263) finds herein an argument for the absence of tectonism during the postglacial transgression period.

It is believed that much of the sediment supply of the Tigris and Euphrates is deposited near the dense reed beds around their levees and the flood-plain splays bordering the rivers, and that only a small portion of the river sediment load reaches the lake and marsh zone (AQRAWI and EVANS 1994, 773). Therefore, recent fluvial sedimentation in the Gulf is limited. Indeed, ever since the Gulf attained its present shoreline (around 6.000 BP), the sediments brought into the Gulf by the Šaṭṭ al-ʿArab and most of the Zagros rivers have been very limited, and the relict sediments [87] in the deeper basins owe their origin to earlier events (SARNTHEIN 1972, 262).

According to SARNTHEIN (1972, 249), these relict sediments cover large parts of the Gulf, are para-autochthonous, [88] and are radiocarbon dated between 7.000 BP and 12.500 BP. He also states that the Gulf has recently received little sedimentation and even that *quantities of sediments delivered by ancient rivers were relatively insignificant* (SARNTHEIN 1972, 259). However, he only investigated the sand-fraction [89] of the "Meteor" samples (SARNTHEIN 1972, 249). Furthermore, the samples are only representative of the Iranian zone [90] of the Gulf.

It is not excluded, therefore, that during the second half of the Holocene, a considerable amount of sediments in the Gulf represent allochthonous, suspended load from former palaeo-Mesopotamian Plain rivers, probably representing various sedimentation rates associated with discharges that differ from the present.

This view is supported by the investigations of BALTZER and PURSER (1990) on the modern alluvial fan and deltaic sedimentation in the Lower Mesopotamian Plain and the Gulf. They see the Gulf principally not as a classical carbonate basin but as an active domain of essentially siliceous and calcareous detrital terrigenous [91] accumulation [92] (BALTZER and PURSER 1990, 175).

Based on echo soundings,[93] UCHUPI *et al.* (1966, 239) reconstructed microtopography and the late-Quaternary depositional history of the Gulf. They were able to determine the

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[87] In the main central part of the Gulf, the percentages of relict sediments in the total samples varies from 0.5% to 75% (SARNTHEIN 1972, 247, Fig.2). Unfortunately, such percentage classes do not allow meaningful estimations of relative abundances.

[88] Deposited *in situ* within shallow water environments, mainly unlithified and partly lithified aragonitic mud (SARNTHEIN 1972).

[89] SARNTHEIN (1972, 249) gives no data on the relative abundance of this fine fraction to the coarse fraction in the samples, but mentions the *terrigenous calcitic clayey mud (marl)* as the present formation matrix of all samples. Even if the fluvial portion for the fine fraction (calcareous clayey marl) always remains < 50 %, it still represents a considerable amount (SARNTHEIN 1972, 259).

[90] Most of the samples are located near the eastern boundary of the Gulf (SARNTHEIN 1972, 247, Fig. 2).

[91] Mainly responsible for this terrigenous input are the flash floods — typical of many arid environments — along the permanent and ephemeral drainage systems of the Zagros chain (BALTZER and PURSER 1990, 175).

[92] Against the para-autochtonous sedimentation of SARNTHEIN 1972.

[93] The echo recordings and bottom samples were taken in 1977 (*Atlantis II Cruise*). In some locations in the Gulf acoustic stratigraphic records were obtained for as much as 50 m with a resolution of less than 5 m (UCHUPI *et al.* 1996, 239).

sites of active sediment accumulation and to map those regions where sediment deposition was slow or non-existent and relict features were exposed.

Their acoustic basement [94] consisted of sediments that were deposited prior to 21.000/20.000 BP and represents an eroded surface [95] of the dry Gulf (UCHUPI *et al.* 1996, 258). Above this basement, sediments were deposited during the 'Holocene' [96] transgression (submergence) and grouped into early and late Holocene deposits [97] (UCHUPI *et al.* 1996, 258).

The 'early Holocene' sediments consist of a lower calcareous terrigenous [98] unit and an upper aragonite-eolian unit (UCHUPI *et al.* 1996, 259). These two units reflect a wet climate phase from 18.000 BP to 12.000 BP and a dry climate phase from 12.000 BP to 9.000 BP (UCHUPI *et al.* 1996, 259).

The 'late Holocene' sediments represent a marl/carbonate unit deposited during the last 9.000 years under a more humid regime (UCHUPI *et al.* 1996, 259). Uchupi *et al.* grouped these shallow sediments of the Gulf into three facies : a marl, a carbonate, and a relict domain (UCHUPI *et al.* 1996, 263). Included with these calcareous and fluvial sediments is a significant component of eolian detritus deposited by the Šamāls (NW winds) (UCHUPI *et al.* 1996, 263).

2.4.3. Sedimentation History of the Northwestern Head of the Gulf

The submarine topography at the head of the Gulf is characterized by northwest-trending relict sandy ridges of tidal-current or eolian origin that are 10 m high and up to 20 km long (UCHUPI *et al.* 1996, 266, 238, Fig. 1). Further south of the delta, UCHUPI *et al.*

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94 Defined as carbonate cemented limestones, which represent reworked older carbonate deposits, and as older limestones.

95 UCHUPI *et al.* (1996, 258) defined an older (30.000 BP) and short-lived transgression phase, during which the Central Basin of the Gulf was inundated and the northwest end of the Gulf was the site of fine grained terrigenous sedimentation (associated with high sediment supply rates during a humid climate in the Iranian Zagros), followed by aragonite and marl. After this transgression, sea level regressed beyond the Strait of Hormuz and climate became dry (lowest sea-level stand was reached 21.000 BP at about -125 m). The Gulf became the site of the continental deposition described by UCHUPI *et al.* (1996, 259) *as a dry depression with large expanses of dunes and swampy/lake areas in the basins.* The sea began to rise again about 18.000 BP, with maximum rates at 12.000 BP and 9.500 BP and a lower rate during the Younger Dryas (11.000 BP to 10.500 BP) (UCHUPI *et al.* 1996, 257).

96 Against the commonly accepted date for the beginning of the Holocene (around 11000 BP), UCHUPI *et al.* (1996, 258) place its beginning at 18.000 BP. Their early Holocene sequence represents a time span from 18.000 BP to 9.000 BP, and the late Holocene sequence was deposited later than 9.000 BP.

97 The early Holocene deposits rest on the acoustic basement ; the late Holocene deposits rest either on the basement or the early Holocene deposits (UCHUPI *et al.* 1996, 258). The mean thickness of the early Holocene unit in the central part of the Gulf is around 20 m. At other locations the isopach map of this unit is not shown since the top of it is impenetrable (UCHUPI *et al.* 1996, 258).

98 This unit is associated with the deposition from a fossil Šaṭṭ al-ʿArab (SARNTHEIN 1972, 245), although other sediment sources of both the Iranian and Arabian flanks are highly probable (UCHUPI *et al.* 1996, 261).

(1996) could deduce a pronounced undulating microtopography from the head of the Gulf to about 26°N. The top sediments were dated as 'early Holocene'.

A smooth sea floor topography is found in the vicinity of Failaka Island at the northwest end of the Gulf where the sea floor is blanketed by two sediment lobes representing either relict deltas or estuarine tidal flats (UCHUPI *et al.* 1996, 245). This suggests a seaward depositional regression.

UCHUPI *et al.* (1996, 266) state that recent [99] fluvial sediment contribution from the Mesopotamian Shelf to the central part of the Persian Gulf and beyond is very low. This is reflected in the characteristics of the so called *Shelf Plain* facies blanketing the region (UCHUPI *et al.* 1996, 266). This facies contains abundant relict (fluvial component) grains, an eolian component, an autochtonous biogenic component, and sand fractions that are higher than the previous facies (UCHUPI *et al.* 1996, 266).

The isopach map of the late-Holocene fluvially derived sediments in the Gulf shows thick deposits (> 20 m) along the Iranian flanks and a blanket of 2 meters on the northwestern part of the Mesopotamian Shelf at about the latitude of 29° N (UCHUPI *et al.* 1996, 264, Fig. 14). This still represents a surface of about 10.000 km^2, reflecting a considerable fluvial input of the Mesopotamian rivers from 9.000 BP onwards.

Late Holocene sedimentation rates appear to have varied with time, and the present rates are much lower than those in the recent past (UCHUPI *et al.* 1996, 266).

Prior to 22.800 BP, at a time when the climate was humid, the northwest end of the Gulf was partially filled with continental terrigenous sediments, mainly from Iranian sources (UCHUPI *et al.* 1996, 266). These deposits were later capped by shallow water marine sediments as the sea transgressed to near the head of the present Gulf (UCHUPI *et al.* 1996, 266). When the sea level dropped to -120 m, the climate was dry and the Gulf was a waterless depression, with eolian and paralic deposition dominating the region (UCHUPI *et al.* 1996, 266).

During the transgression from 18.000 BP to 12.000 BP thick terrigenous wedges were deposited in the central and northwestern Gulf, under a more humid climate (UCHUPI *et al.* 1996, 266).

From 12.000 BP to 9.000 BP the climate became dry again and in the shallower areas aragonitic sediments formed, whereas in the non-inundated areas eolian sediments were deposited. Transgressive phases reworked and redeposited previous deposited sediments. After 9.000 BP the climate became moist again and river run-off built a series of southeast trending sediment lobes (wedges) along the northeast side of the Persian Gulf (UCHUPI *et al.* 1996, 266). Since the present arid climate was established in Arabia around 6.000 BP, sediment supply to the Gulf from Arabia has been negligible. By 5.000 BP the sea transgressed across the Arabian coastal zone to an elevation of about +1 m and inundated the head of the Mesopotamian Valley (UCHUPI *et al.* 1996, 266). According to UCHUPI *et al.*

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[99] Indeed the delta has been blocked since 2.000 BP (Rzóska 1980, 55, Fig. 23, based on *Handbook of Iraq* 1944).

(1996, 266) tectonism and construction of the Tigris-Euphrates Delta led to the Gulf's present configuration.

2.5. Summary Mesopotamian Flood Plain

The Holocene Mesopotamian flood plain consists of the present meandering and anastomosing rivers flood plain and abandoned flood plains. It is in essence a broad, aggradational flood plain, dominated by migration of natural levees and vertical flood basin accretion, confined at the flood plain borders by progressive alluvial fan development or sea-level rise.

During the transition period of the Pleistocene/Holocene and early (mid) Holocene, considerable fluvial erosion under essentially wetter conditions must have modified the flood plain, as is evident from the downstream sedimentation in the Gulf. This erosion was, during the first half of the Holocene, enhanced by the lower base level. During the second half of the Holocene net aggradation (accelerated sedimentation) became dominant, and later anthropogenic factors strongly influenced these sedimentation patterns.

Our working hypothesis is that during the second half of the Holocene a decrease in river discharge and changes in sediment-load (size and amount) supply and river-bank vegetation caused a gradual change in river channel patterns from a (anastomosing) multiple-channel flood plain to the present dominant meandering river pattern and aggrading flood plain.

Presently this flood plain is changing dramatically due to intensive waterworks, which are destroying much of the evidence of flood plain evolution.

3. Changing Rivers

3.1. Fluvial System Variables and Controls

Rivers change because they adjust to fluctuations in the variables and/or controls (independent variables) of the fluvial system. Such adjustments are not random but rather have complex internal relationships. Meander wavelength, for example, increases with increasing water discharge, but it also depends on the type of sediment load moved through the channel (Schumm 1967, 1549). Variables of river systems can be grouped based on their spatial scales. Usually when variables are applicable at macro-scales, they are viewed as independent controls of the river system (e.g. independent or environmental basin controls). However, the status of variables (independent, dependent, or indeterminate) changes when considered over different time-scales (Schumm 1977, 96-100; Knighton 1984, 162-189).

These include local hydraulic variables such as flow velocity and sediment transport rate, fluvial regime variables such as slope or gradient, channel pattern, and hydraulic geometry, fluvial basin variables such as vegetation, slope steepness, drainage texture, and

water and sediment yield, and regional variables such as climate (precipitation, temperature, etc.) and geology (lithology, structure, tectonic status, initial relief, etc.) (ALLEN 1977, 16).

A discussion of the dependent variables, the independent controls, and their interrelationships, is beyond the scope of this contribution.[100] However, some general concepts on changing rivers are given below.

3.2. Changes over Different Time Scales and Equilibria Concepts

It is commonplace that rivers, being the central component of the fluvial system, are dynamic, ever changing, ever adjusting, both over time and space. It is therefore necessary to define the temporal and spatial scales under consideration or to know the appropriate scales for such changes. Adjustments of rivers are understood within the system concepts of process-response theories ; they can be attributed to either short, medium, or long-term changes and can have spatial implications at different scales.[101]

Spatial scales in fluvial geomorphology are easier to define than temporal ones, since rivers and associated landforms usually have well-defined spatial boundaries. As such, spatial scales can include the entire fluvial system, the different zones of upstream sediment-source, transfer or downstream deposition, or they can be applicable to an individual reach segment. However, the evaluation of the geographical extent of certain fluvial processes remains difficult,[102] if not impossible, as is for instance the case for flood-area prediction or geomorphic hazards (MORISAWA 1994).

The use of an appropriate time scale for fluvial systems has been a source of continuous debate (KNIGHTON 1984, 1). This is mainly due to the difficulties [103] involved in attributing absolute time spans or rates to fluvial processes in general and the variability and range of these processes. These concepts of time scales are important however, since they influence our conception of equilibrium [104] within rivers, the relationship between cause and effect of river system variables,[105] and the significance attached to the magnitude or

[100] See e.g. KNIGHTON 1984, 2, for a general overview of these interrelationships.

[101] For system concepts, see e.g. WHITE *et al.* 1992. For geomorphic responses to short-term changes, see e.g. KOCHEL and MILLER 1997.

[102] Fractal statistics may be applicable here, as extremely small accidental perturbations can cause a system to become unstable and lead to rapid changes.

[103] "*The present is too short to be the key to the past*" (AGER 1973, cited in SCHUMM 1977, 6). However, according to Schumm, fluvial processes are uniformitarian (SCHUMM 1977, 7). Usually, these difficulties involve the lack of a high resolution geochronology due to inadequate dating techniques. Eventually, integrated geoarchaeology research can fill this gap.

[104] For the concepts of equilibrium within fluvial systems, see KNIGHTON 1984, 90-94 ; EASTERBROOK 1993, 125-131. ; SCHUMM 1977, 9-13.

[105] There are many river variables affecting river changes, and between some of them causal linkages exist. The recognition of causality requires the definition of independent (controls) and dependent variables. Such dependencies are related not only to spatial scales but also to time scales. As an illustration of the relation between cause-effect relationships and time scales, SCHUMM (1972, 379) gives an example of the hydraulics of flow (flow characteristics), which are dependent river variables over a steady (very short) time scale. As

frequency [106] characteristics of the processes (KNIGHTON 1984, 1). Furthermore, the status [107] of the river variables that influence both river morphology and behavior vary accordingly to the time scales being used (SCHUMM 1977, 96-100).

These time scales are closely related to equilibrium concepts in geomorphology, or more specifically, to the time spans that are thought to elapse in order to attain the equilibrium type.[108] SCHUMM (1977, 10) suggested that landform changes can occur over three *time scales*: cyclic, graded, and steady. He developed a model of equilibrium components, based on episodic erosion, in order to project river changes and landform evolution in general against a time scale (SCHUMM 1977, 12).[109]

The time periods defined by KNIGHTON (1984, 87) will be used here. He proposed following: the instantaneous time (< 10^{-1} years), short time scale (10^{1}-10^{2} years), medium time scale (10^{3}-10^{4} years), and long time scale (> 10^{5} years). For a fuller treatment of this topic, we refer to this work. Figure 5 illustrates the use of these time scales against a change in discharge.

True stability never exists in natural rivers, although, for a certain time scale, relatively constant conditions of controls (controlling variables) may be achieved and the rivers may develop characteristic forms (KNIGHTON 1984, 90). Various types of equilibrium can be defined, of which three are particularly relevant in geomorphic systems: steady-state equilibrium, declining equilibrium, and dynamic equilibrium (EASTERBROOK 1993, 9).

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such the helicoidal flow in a river meander is not the cause of meander formation but rather reflects the presence of the bends. In other words, the sinuosity of the river influences the flow character and not the reverse (SCHUMM 1972, 379). Meander formation occurs over a longer time scale as a consequence of river adjustments to variables like slope, sediment load, and discharge.

106 As an example we might give here the recurrence interval (return period) of floods, which is defined as the average time interval, usually in years, between occurrences of floods. The reciprocal, or inverse, of the recurrence interval is the probability (chance) of occurrence, in any year, of a flood equaling or exceeding a specified magnitude. For example, a flood that would be equaled or exceeded on the average of once in 100 years would have a recurrence interval of 100 years and a 0.01 probability, or a one percent chance of occurring or being exceeded in any year (WATER WORDS DICTIONARY, NEVADA DIVISION OF WATER PLANNING, Carson City 1997). Consultable at *http://www.state.nv.us/cnr/ndwp/dict-1/waterwds.htm* (last revision 03/12/97).

107 The status of a variable changes when considered over different time spans of different durations. The status of a river variable can be either independent, dependent, irrelevant, or indeterminate. As an example we might give the river variable of channel morphology. During a long time span of river change (cyclic time), this variable is indeterminate; during a shorter time span (graded time), this variable becomes dependent. When river changes are considered instantaneously (steady time), the channel morphology becomes an independent variable since it has been inherited from graded time. As such the channel morphology controls (as an independent variable) short term variations in flow velocity, water depth, or sediment transport within the channel cross-section. The only dependent river variables during steady time are the measured discharge of water and sediment and flow hydraulics at that specific time (SCHUMM 1972, 376-377).

108 Other types of equilibria are static, steady-state, declining, dynamic, and metastable (EASTERBROOK 1993, 8). For a general introduction to equilibria in systems, see WHITE *et al.* 1992, 490-496.

109 He associates cyclic time (on the order of 10^{6} years) with a *dynamic metastable equilibrium*; graded time (order of 10^{2}-10^{3} years) with *steady state equilibrium;* and steady time (order of one day) with *static equilibrium* (SCHUMM 1977, 12).

Steady-state equilibrium occurs under conditions that change very little over time and the relationship between form and process is stationary. Declining equilibrium occurs when the rate of change drops over time to successively lower rates of change. Dynamic equilibrium consists of small variations around a changing average condition. This last type is characteristic of graded streams and grade slopes in the classical cycle of erosion (EASTERBROOK 1993, 9). When certain geomorphic thresholds are exceeded, a sudden change in the system can occur (metastable) and afterwards a new dynamic equilibrium can be installed.

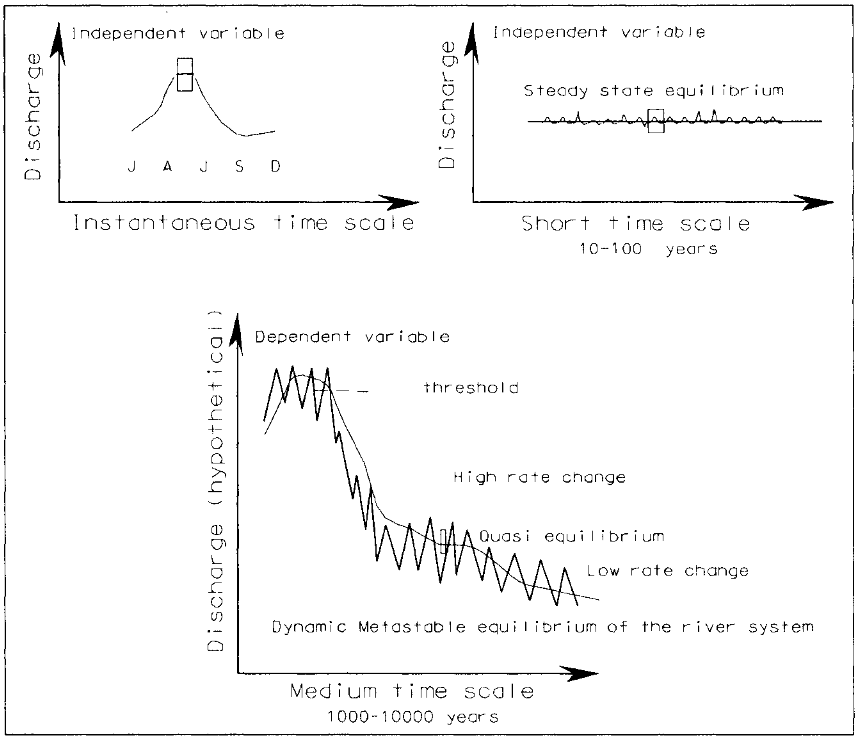

Fig. 5. Visualization of the Use of Different Time Scales for River System Changes, as Applied Here. The changes of one river variable (discharge) are plotted against different time scales and associated equilibrium status of the river system. The changes displayed at the medium time scale are hypothetical (modified after KNIGHTON 1984, 91, Fig. 4.2.A).

As an example of a steady-state equilibrium model applicable to all the variables of the entire fluvial systems, we can state e.g. that an open fluvial system over a relative short time scale can be seen as a self-adjustable balance between input and output controls through changes in river morphologies (mostly in adjustments of cross-sectional form, river patterns or slope) within the system in order to maintain sediment and water transport continuity in the (energetically) most efficient way. If one input control changes (e.g. if there is an increase in sediment load supply due to overgrazing), the fluvial system will adjust itself (via positive or negative feedback) towards a new equilibrium in which this increased sediment supply will be transported in the most efficient way and towards a new balance between input and output controls. In the case of an increase in sediment supply and constant discharge, this sediment surplus will be deposited within the river channel, thereby

increasing its gradient and thus transport capacity until further deposition is prevented and a new equilibrium condition is attained. If all other input controls remain constant, a decrease in discharge will essentially have the same result: the transport capacity of the stream channel will decrease and the sediment load will be deposited. Needless to say, fluvial geomorphic responses are much more complex, since usually more than one input control changes and the different input controls are interdependent and interfere with one another.

The concept of equilibrium has a long history in geomorphological literature. *However, there is as yet no universally accepted set of criteria for determining whether all or part of a river system is in equilibrium* (KNIGHTON 1984, 92). One can question if such a concept of equilibrium has any practical significance, and if such equilibrium conditions will ever be attained in nature. However, empirically it was found that at each location along the river profile a series of relationships exists among the following: discharge, amount of sediment supply, channel cross-section, roughness of the bed form, size and type of sediment load, velocity, and slope (LEOPOLD *et al.* 1992, 266-281). Rivers adjust themselves towards a quasi-equilibrium among these variables.[110]

The concept of equilibrium, we believe, can provide useful qualitative explanatory models as working hypotheses in order to model changes of the geomorphic system over short to long time intervals and to define, eventually, the spatial extent of such changes.

Before we briefly comment on some actual changes of rivers that can occur, we will quote Knighton one more time, regarding the concept of equilibria in fluvial systems:

Rivers can at best attain an approximate equilibrium, manifest at some suitable time scale intermediate between short-term fluctuations and long-term evolutionary tendencies in a regularity of channel geometry adjusted to external controls. In order to assess the ability of the fluvial system to make the necessary adjustments, there is a need to know the time period required for a stream to develop characteristic forms and the time period over which such forms are likely to persist. Different components of channel geometry adjust at different rates so that both time periods may be expected to vary from one component to another. The potential for adjustment also depends on the scale and resistance of the system so that any tendency toward equilibrium may vary not only between river systems but also between different parts of the same system. As yet there is no suitable theory which can cope with all ramifications to the equilibrium concept (KNIGHTON 1984, 94).

3.3. River Channel Changes

Throughout the Quaternary, river systems have adjusted to fluctuations in discharge and sediment load. High discharges have been associated with the development of high

[110] As such, discharge and amount of sediment supply are regarded as independent (external) variables (on short-term scale), whereas slope or gradient adjustments are totally dependent variables of the fluvial system in order to maintain this condition of quasi-equilibrium. In the classical concept of the graded stream, as defined by MACKIN (1948, 471), equilibrium conditions are achieved only by slope adjustments. The other morphological factors vary interdependently with one another during river adjustments.

amplitude and long wavelength meanders, initiation of braiding, and phases of aggradation or incision. Periods of low discharge have been related to channel metamorphosis from braiding to meandering patterns and incision (BREWER and LEWIN 1998, 989, and references therein).

River changes can be due to changes in extrinsic controls and/or intrinsic controls. Extrinsic control changes include, for instance, climatic change, tectonics, or human activity. Intrinsic control changes are inherent in the fluvial system and involve, for example, channel migration, cut-offs, and avulsion. In general, responses to extrinsic changes are recorded over long-term periods, and responses to intrinsic changes are instantaneous or short-term events. However, as one might expect, fluvial responses are much more complex and the causal factors are not always clearly delimited. A sudden fluvial response may occur when certain geomorphic thresholds are exceeded because of small intrinsic changes or large extrinsic changes (BREWER and LEWIN 1998, 990 ; GOUDIE Ed. 1995, 505).

Different aspects of river channel changes are discussed in detail in GREGORY Ed. 1977. There a distinction is made between changes of channel geometry, river channel patterns, and river network changes (GREGORY Ed. 1977). We will briefly discuss some common river channel changes that can occur during short and medium time periods.

3.3.1. Intrinsic Changes Due to Normal 'Steady State' Fluvial Processes in Short Time Periods

Common river channel changes in planform that are due to normal geomorphic evolution [111] of the fluvial system are meander cut-offs,[112] avulsions, and lateral migrations of meander belts. Usually such changes are manifested within short or even instantaneous time periods. They occur when certain geomorphic thresholds are exceeded (SCHUMM 1977, 8). Although they develop within the normal evolution of river systems on a micro or local scale and as such are not responses to major environmental changes, their impact on societies dependent on irrigation may be considerable, if not dramatic. Figure 6 depicts a meander cut-off in our study area and the successive adaptations of irrigation canal off-takes.

A similar process occurred on the Tigris 5 km downstream from Seleucia. The present, huge abandoned meander is shown as still active on Bewsher's map [113] of 1885, but is mapped as an oxbow lake on maps of WWI (see also Fig. 1 in Cole and Gasche in this volume).

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[111] Here normal geomorphic evolution is understood as evolution under steady-state equilibrium. The inputs to a geomorphic system may vary through time, for example on a seasonal basis, but so long as average annual input is constant the system state is constant, and the equilibrium is one in which the relationship between form and process is stationary (GOUDIE Ed. 1995, 184).

[112] Two forms of meander cut-offs can occur: the neck cut-off and the chute cut-off (ALLEN 1965, 119, Fig. 16).

[113] SELBY, W.B., COLLINGWOOD, W., BEWSHER, J.B., 1885 *Surveys of Ancient Babylon and the Surrounding Ruins with Part of the River Tigris and Euphrates ... in 1860 to 1865*, London, 6 sheets published in 1885, British Museum.

The downstream migration [114] of meanders is another aspect of river channel changes. Such a gradual change has destructive effects on any remains along the river channel. Although ADAMS (1981, 8) found little if any evidence of such migrations, translations [115] of meander loops do occur more than just sporadically along the present Tigris. However, we agree that the process of meander cut-offs is dominant. Meander forms are usually asymmetrical [116] and often display a 'gooseneck' planform (Figure 7).

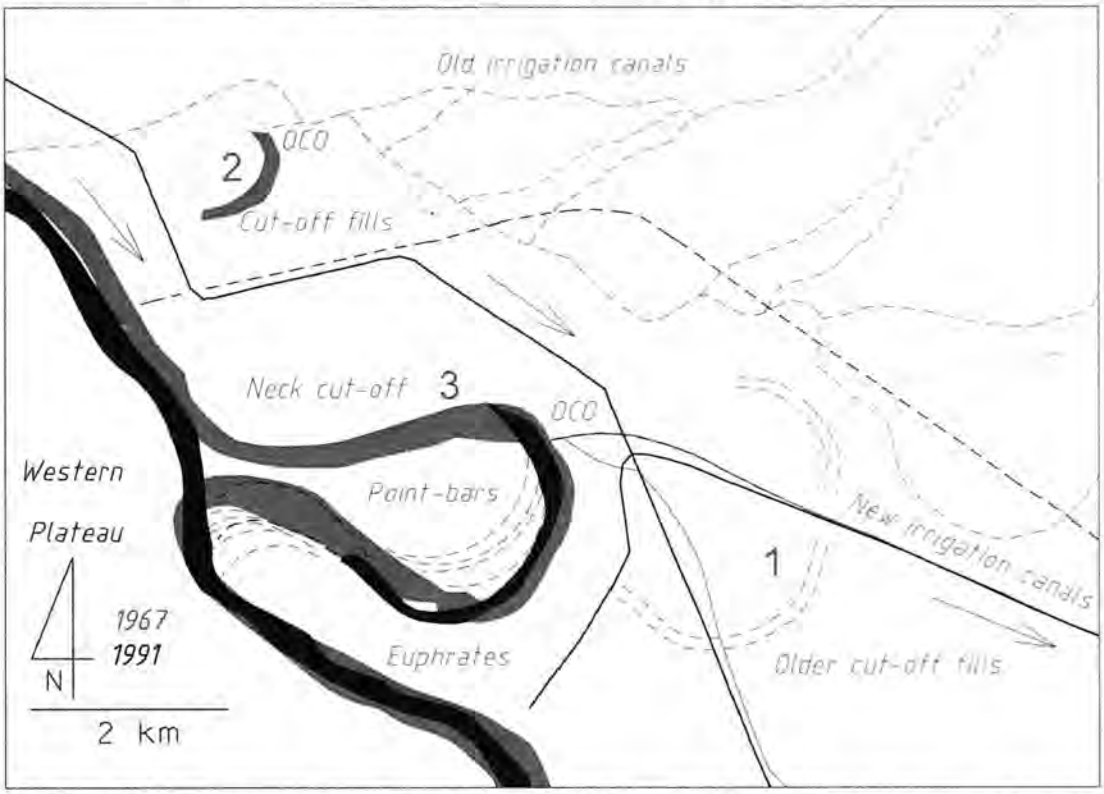

Fig. 6. Short Term River Channel Changes, 10 km Upstream from the Iskandarīyah Terrace. Different successive neck cut-offs (1,2,3) of the Euphrates, showing how old canal off-takes (OCO) became unusable for irrigation water supply. In gray: the situation as visible on Declassified Intelligence Satellite Photos of 1967, in black: the situation in 1991 as visible on SPOT panchromatic images. The pattern of meander cut-off 1 is still visible in the field orientations on SPOT (for localization see Figure 10).

Changes of river channels within the confined zone of the meander belt are of course limited in space, but they can have important consequences.[117]

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114 Migration of meanders can occur in different forms or combinations of forms: rotation, translation, extension, or enlargement (BROWN 1997, 27, Fig. 1.4.b.)

115 See KNIGHTON 1984, 140, for the different meander migration patterns.

116 Based on this asymmetry flow direction can be deduced. For the causes of asymmetry, see CARSON and LAPOINT 1983.

117 See e.g. LE STRANGE 1905, 36; see also GULLINI 1966, Pl. I, on the changes of the Tigris bed after the 5th century AD in the area of Seleucia and Ctesiphon and the partly eroded site of New Seleucia (Coche) due to this change.

Avulsions of river channels have a more regional impact [118] and occur suddenly for the most part. Avulsion is common to all river channel patterns, but is most common for anastomosing rivers (BROWN 1997, 29). These phenomena can occur repeatedly, so that previous flood basin areas are covered by new levee and flood basin systems. Human interference can slow this process down but demands intensive efforts.[119]

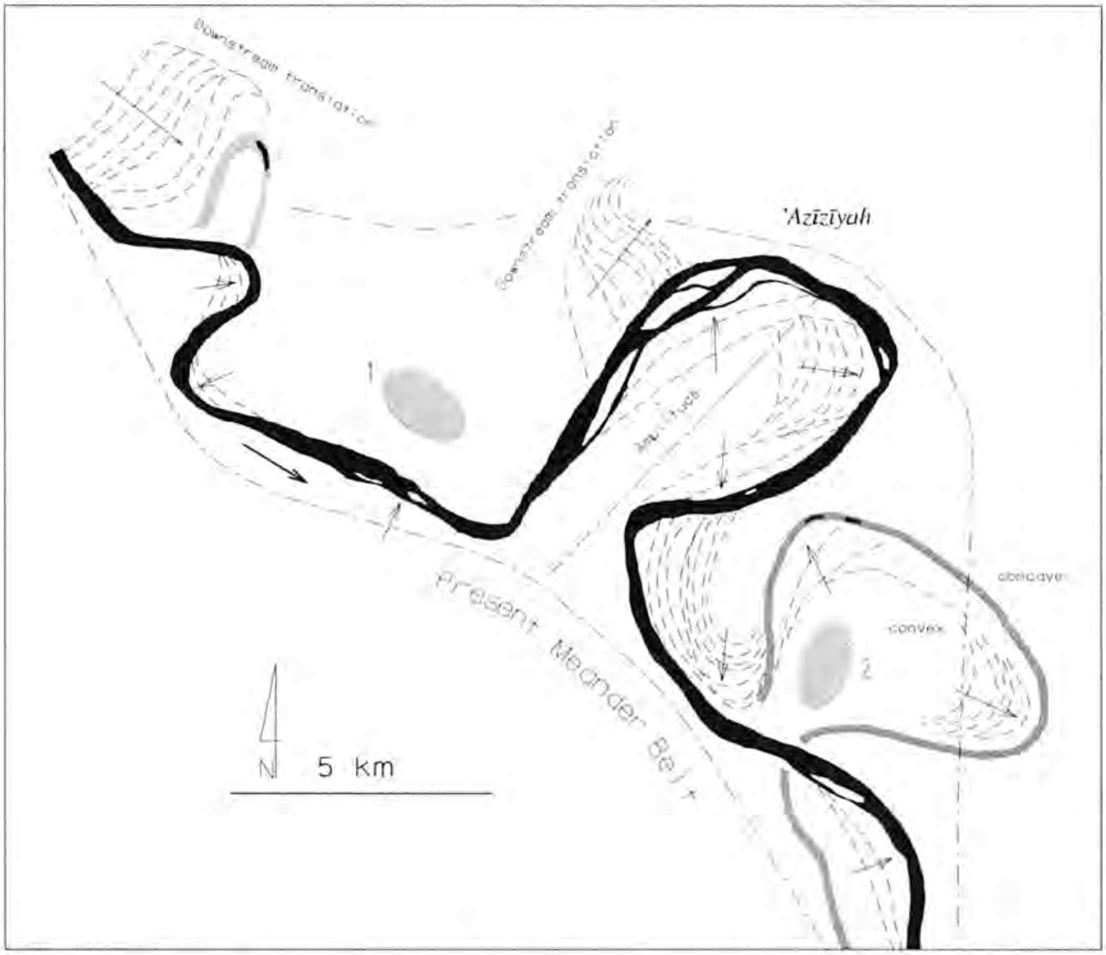

Fig. 7. Evolution of Meanders on the Present Tigris. Showing the typical 'gooseneck' loop at 'Azīzīyah, the 'gooseneck' cut-off, and the downstream translation of meanders. Dotted lines represent point bars. The essentially Islamic site (1) of Dayr al-'Āqūl was situated on the other side of the Tigris in the 10th century AD, but must have been located on its present left bank in the Sasanian period, since it was situated on an effluent of the northern lying Nahrawān canal (ADAMS 1981, 197). The other essentially Islamic site, (2) Humānīyah, is less problematic. Situated on the convex side of the former Tigris channel, it was, at least on the short-term, protected against river changes.

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[118] See e.g. COLE 1994 on the westward shift of the old Kish-Nippur branch of the Euphrates around the end of the second millennium BC and the consequences of later marsh formation in flood basins in the Borsippa region.

[119] See e.g. the shift of the main flow of the Euphrates from the Šaṭṭ al-Ḥillah to the Šaṭṭ al-Hindīyah (GIBSON 1972, 26ff).

This dynamic development must have occurred several times in the Mesopotamian flood plain and gave rise to a very complex and poly-cyclic geomorphological pattern as sediment layers of different sedimentation processes were superimposed. Thus it is very likely that the fine-textured surface and subsoil layers of a recent basin area overlay a coarse-textured substratum belonging to an older levee system. In this way vertically stratified complex sediments are formed with a high spatial variability of different textures. To complicate matters, silt has been transported to the plain by canals and irrigation feeders and deposited during irrigation. These irrigation deposits can be several meters thick and can mask completely the original natural sediments.[120] Therefore it is necessary to differentiate between natural sediments and irrigation sediments in order to understand the building up of the Mesopotamian flood plain.

Gradual, lateral migrations of meander belts as a whole can occur as well. These are even more destructive than single meander migrations. There is evidence that such a westward [121] gradual migration occurred in our study area, which we will describe later. However, avulsion must have been the dominant process, since otherwise much of the archaeological evidence still visible today would have been destroyed.

3.3.2. Extrinsic River Changes (Medium Time Periods)

River changes over medium time periods are usually the result of gradual environmental changes such as decrease in discharge, sediment load supply, or bank vegetation. These can be viewed as dynamic changes to variations in independent (extrinsic) fluvial controls. Usually such river changes are climatically induced, but other controls, such as neo-tectonic movements or changes in upstream catchment areas, can occur as well (BROWN 1997, 31). If such an input control is changing through time sufficiently slowly for the river system to adjust, the condition is called a dynamic equilibrium. However, there is always a lag in time between the change in the input variable and the internal morphological adjustments of the system (GOUDIE Ed. 1995, 185). Estimations of the length of such a time lag are extremely complex and make the interpretation of landscape changes very difficult.

River channel changes depend also on river bank resistance and available stream power. Channels are relatively stable when they flow within cohesive banks (silts and clays) and bank vegetation increases this stability even more. As one might suspect, the ratio of stream power to bank resistance is the most obvious control on modes and rates of channel change (BROWN 1997, 26). Changes of this ratio are usually due to extrinsic changes of river controls. However, such extrinsic changes can occur both over the short-term or the medium-term. Changes in sediment-load supply due to upstream deforestation can be

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[120] HARRIS and ADAMS 1957 ; BURINGH 1960.

[121] Such migration can be attributed to the coriolis acceleration caused by the rotation of the earth. Many large rivers in the northern hemisphere that flow more or less parallel to the meridians have a tendency to migrate to the right in the direction of their flow (FRIEDMAN *et al.* 1992, 281). See, e.g., the shifting of the Nile towards the east (BROWN 1997, 7). The Euphrates gradually shifted westwards during the second half of the Holocene.

evident over a short-time period. Such changes of the input controls may cause siltation of channels and a shift from a more (multi-channel) anastomosing river pattern towards a bi- or tri-channel one.[122]

4. ENVIRONMENTAL CHANGE

For many years global environmental change has been a major research topic in numerous international scientific organizations. The changing climate in particular was accorded status of utmost importance for scientific environmental research. The archaeological evidence and historical data of the Mesopotamian Plain, useful for documenting such environmental changes, are still largely neglected and are not yet fully incorporated in this research.[123]

Since environmental change can be examined across a range of spatial and temporal scales, it is important to distinguish the changes which are recognized on the one hand as regional, gradual, and mid- to long-term *processes* (sea level changes, soil degradation, vegetation changes, etc.) and on the other hand as *events* (palaeo flash-floods, river avulsion, abandoned meander belts, etc.) that are more local and short-termed but frequently catastrophic. Furthermore the changing environment may be due to a variety of natural causes and/or human interference. Understanding these environmental changes is important for the understanding of the ancient civilizations of Mesopotamia and vice versa. Unfortunately, even the major environmental fluctuations witnessed by the Mesopotamian Plain are poorly understood (POSTGATE 1992, 21).

4.1. Climatic Change

A detailed discussion of the climatic changes that occurred during the late Quaternary in the Lower Mesopotamian Plain is beyond the aims of this contribution.[124] Climatic changes, directly expressed in changes in temperature, precipitation, or vegetation, are, of course, important factors contributing to the nature and intensity of geomorphic processes (RAPP and HILL 1998, 108). Holocene climates may have deviated significantly from present-day climates, and the geomorphic responses to such changes will be preserved in sedimentary sequences and in landforms (RAPP and HILL 1998, 108). COURTY (1994, 54), for example, attributed the geomorphological evolution of the Upper Ğazīrah mainly to

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[122] This can explain the apparent contradictions in Old Babylonian textual evidence showing siltation of channels and high-flood risks in others, since the discharge could not be diverted anymore by way of various branches and people had to protect themselves by the construction of dikes.

[123] *http ://www.ngdc.noaa.gov/paleo/data.html* (last revision 02/10/99).

[124] For late-Quaternary climatic changes of bordering areas, see SANLAVILLE 1996 (Levant) ; SANLAVILLE 1992 ; LÉZINE *et al.* 1998 (Arabian Peninsula) ; HOLE 1994 (Tigris-Euphrates basin) ; ROBERTS and WRIGHT 1993 ; BUTZER 1975, 1995 (Near East in general), and *Paléorient* 1997 23/2 (for e.g. the Anatolian and Syrian region).

climatic fluctuations throughout the Holocene. Unfortunately, there are not enough proxy records available for our study area to reconstruct even global trends, so that any environmental reconstruction for the Mesopotamian flood plain will remain strongly hypothetical. Or, as Potts has stated, views on the palaeoclimate in southern Iraq are *as changeable as the weather* (POTTS 1997, 3). We believe, however, that Holocene climatic fluctuations must have had an important impact on the geomorphological settings of the flood plain.

On a global scale [125] there exits general agreement on two major trends with regard to the Holocene period. First, there is now general agreement on the so-called global mid-Holocene "Warm Period" from roughly 7.000 to 5.000 BP. This period is characterized in the northern hemisphere by warmer summers and colder winters.[126] However, there is no evidence to show that the average annual mid-Holocene temperature was actually warmer than present temperatures.[127] Secondly, there is also general agreement on the last 1.000 years, where it is shown that, prior to 1900 AD, annual temperature anomalies for the northern hemisphere did not exceed 0.5°C.[128] However, *there are not enough records available to reconstruct global or even hemispheric mean temperature prior to about 600 years ago with a high degree of confidence.*[129]

4.2. Geomorphic Response

The behavior of a river system may vary in time due to changes in environmental conditions. Certainly two (related) kinds of changes in river behavior are indicated in our study area during the Holocene period. At first there is a change in the sedimentation rates, and then there is a change in the river pattern.

The temporal variations in the Holocene sedimentation rates are probably due to the combined effect of medium-term, dominantly natural sedimentation processes and short-term anthropogenic accelerated sedimentation processes. This natural sedimentation probably started already during the late-Quaternary transgression. The precise morphological consequences of the sea level rise for the two river systems are not yet fully understood. Presumably the corresponding changing equilibrium in each system caused an increasing zone of deposition downstream and an increasing zone of river incision upstream. The impact of Holocene climate fluctuations on this natural sedimentation is still unclear. Again, climatic change is not well understood and its local effects cannot yet be completely documented (HOLE 1994, 121). Surely, climatic change resulted in flow regime changes of

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125 The northern hemisphere in particular.

126 The causes are attributed to changes in the Earth's orbit (NOAA PALEOCLIMATOLOGY PROGRAM 1999).

127 NOAA PALEOCLIMATOLOGY PROGRAM 1999. Consultable at *http ://www.ngdc.noaa.gov/paleo/paleo.html* (last revision 02/10/99) *and http ://www.ngdc.noaa.gov/paleo/globalwarming/holocene.html.*

128 This diminishes the global importance of the Medieval Warm Period (9th to 14th centuries) and to a lesser extent the later Little Ice Age.

129 *http ://www.ngdc.noaa.gov/paleo/globalwarming/medieval.html.*

discharge and sediment load and in changing vegetation cover, exerting a great influence on the morphology of the channel pattern (PETTIJOHN *et al.* 1987, 121).

Anthropogenic accelerated sedimentation is probably the main process in the formation of river levees and probably started, at different rates, during the second half of the Holocene.

Although we are not able to date it, we can agree with NÜTZEL (1979, 228) that a transition from a braided river system [130] to the present meandering system must have occurred in our area in late-Quaternary times, but probably via an anastomosing transitional phase. We believe that the latter transition occurred during the second half of the Holocene.

5. THE PRINCIPAL ACTORS: THE TWIN RIVERS

Paraphrasing, we can state that Mesopotamia is a poisoned gift of the Twin Rivers or a vital curse, since "*... the watercourses constituted a latent threat to the very existence of civilization in the alluvial plain*" (ROWTON 1969, 307). Indeed the first urban civilizations had to cope with the unpredictable and unreliable behavior of the changing Euphrates and much later [131] — when technical or organizational achievements allowed better water management — the even more dangerous Tigris. Over the medium-term the use of their water for irrigation, without efficient drainage, gradually caused salinization, so that every year spring floods or potential summer droughts called for hard labor and creative adaptations. Furthermore, the timing of the arrival of high and low waters are unfortunate for the real water needs of the Mesopotamian farmer (POSTGATE 1992, 178, and ADAMS 1981, 3). Notwithstanding, the Twin Rivers were, and still are of course, as Adams stated for the Euphrates, *a ... pulsing artery that carries the gift of life* (ADAMS 1981,1).

It is evident that one cannot understand the morphology, behavior, and evolution of the rivers without a clear comprehension of the fluvial geomorphic systems in their entirety

[130] In case of the Khabur River, for example, the response was a dramatic shift after 5.000 cal BC from a sandy, braided, semi-arid river channel, with periodic floods, to a silty, meandering one, with perennial flow, flood plain stability, and a dense, fringing woodland (BUTZER 1995, 127).

[131] In our study area the Tigris played, in a more ancient past, a less important role than the Euphrates for irrigation (see GIBSON 1972, 24). Indeed the discharge of the Tigris shows a greater variability and bigger difference between high and low water stages than the Euphrates. The Tigris is also incised more deeply, which makes it more difficult to be used as a feeder off-take for non-parallel irrigation canals. It is therefore only from Seleucid times — and principally from the Sasanian and Early Islamic periods — that Tigris water was used to fill irrigation canals. From Sasanian times onwards Tigris water even became a vital supplement to Euphrates water (ADAMS 1981, 7). More to the south of the study area, there are indications that either in the Neo-Babylonian or the Achaemenian period, Tigris water was used as an irrigation source, probably with ancient lifting technology (ADAMS 1981, 192, 350). However, see POTTS (1997, 9 and references therein) for a reconsideration of the importance of the Tigris River.

(SCHUMM 1977, 2). Such a unified approach to the Twin Rivers [132] and the Mesopotamian Plain does not exist and requires a multidisciplinary integration of data from both upstream controls (e.g. climate, changes in river catchment area, drainage pattern, sediment source area, data on river captures, land-use and vegetation changes, recent geologic history, etc.) and downstream controls (e.g. anthropogenic river bank enforcements or deformations, river channel morphologies, water utilization by man, base level changes, flood plain compaction and subsidence, etc.). Fluvial systems are dynamic and their characteristics vary over time and space with any changes in up- or downstream controls. Therefore, the modern rivers cannot be fully appreciated without knowledge of their history, nor can their history be correctly interpreted without an understanding of their hydraulics and sediment behavior.

5.1. Twins, Similarities and Differences

The Euphrates river is nearly 2600 km long, of which 1140 km run through Iraq. The Tigris river is nearly 2000 km long to its junction with the Euphrates at Qurnā, of which 1360 km run through Iraq (RZÓSKA 1980, 42).

5.1.1. Present Flow Regime

In regime, the Tigris and Euphrates are similar (LEBON 1955, 49). Both rivers have their lowest discharge in August-September and a snow-melt regime in spring. The Tigris has a smaller catchment area than the Euphrates but a larger annual discharge. The influence of winter rains [133] is more apparent in the Tigris than in the Euphrates. The regime of the Euphrates is more regular than that of the Tigris. The maximum discharge of the Tigris occurs in April ; for the Euphrates it does not occur until the first half of May. Figure 8 displays the discharge data of the Twin Rivers.

At Hīt, on the Euphrates, the normal difference between high and low levels is around 3.5 m ; at Baghdad the Tigris can rise about 5.5 m (Figure 9). The maximum water levels of both rivers are higher than the flood plain, but the summer water levels are below the flood plain level. As a consequence, winter cultivation depending on flow irrigation predominates unless the water level is raised during summer and water is stored artificially.

One of the major problems with irrigation water is the high suspended load (silt) content. This silt is deposited in the irrigation canals, and therefore either a continuous cleaning of the canals is necessary, or the slope of the canal must be sufficient to prevent deposition of this sediment. As mentioned earlier, the extreme variability of the amount of

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132 Two often cited books are *The Régime of the Rivers Euphrates and Tigris,* London, by IONIDES (1937) and *Geographical Handbook Series of Iraq and the Persian Gulf,* London, by NAVAL INTELLIGENCE DIVISION (1944). Unfortunately, the author did not have the opportunity to consult these two publications.

133 The amount of precipitation that actually contributes to direct runoff depends not only on infiltration and storage capacities, but also on the type, intensity, and duration of the precipitation. Rain-on-snow-cover precipitation is classified as a high-runoff event (EASTERBROOK 1993, 109). Therefore winter rains during February can cause disastrous flooding too (LEBON 1955, 50).

suspended sediment is an important but difficult to assess characteristic. The average data of dry gram/m^3 for the Tigris is around 800, whereas for the Euphrates it is around 550 (AL RAWI 1967, 45).

Since the sediment discharge peak in rivers is usually earlier than the water discharge peak, relatively less sediment contributes to the vertical accretion of the flood basins than to the channel aggradation (MORISAWA, 1985, 119).

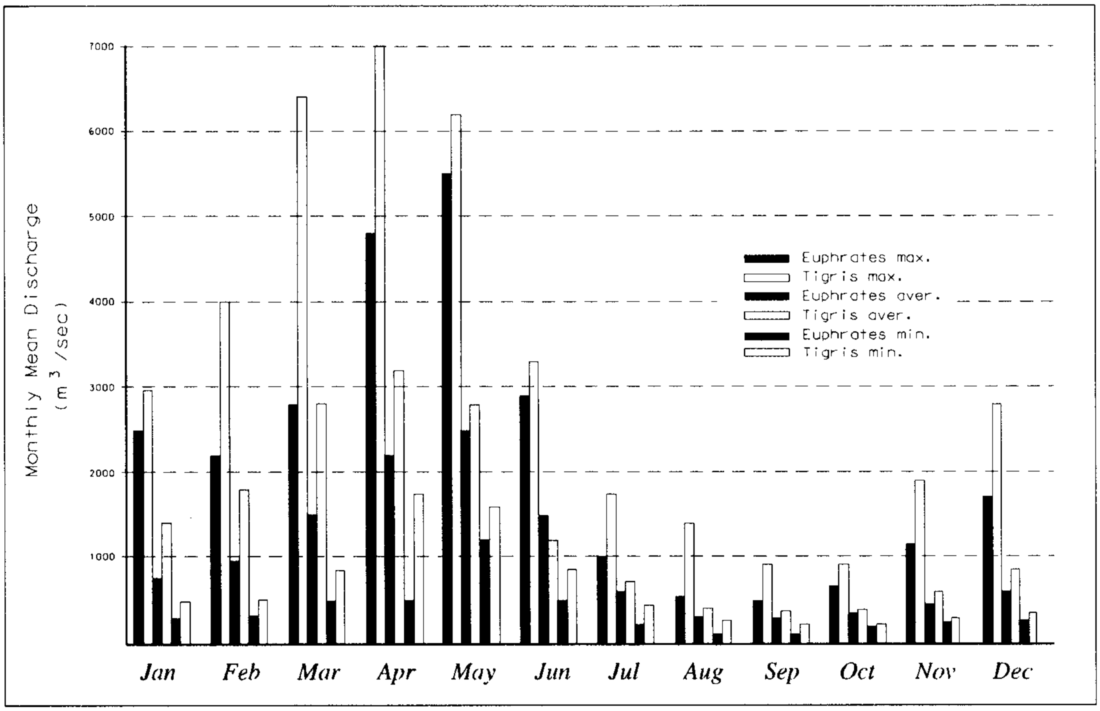

Fig. 8. Discharge Data for the Euphrates at Hīt and for the Tigris at Fatha. Data are from the period 1931-1966. Lebon recorded a maximum peak discharge of 14800 m^3/sec on 02/02/41 for the Tigris, but this peak was probably exceeded during the disastrous flood of March 1954. The general trend displays a delay of the peak discharge of nearly one month for the Euphrates (after ADAMS 1981, 4, and LEBON 1955, 49, 50). For comparison : the monthly discharge data for the late-summer flood of the Nile in 1923 varies between 7000 and 8500 m^3/sec (PAULISSEN 1991, 229).

5.1.2. Floods

Before governmental flood control projects on the Euphrates and the Tigris were begun in the 1950s, basins in the flood plain were liable to unpredictable inundations during the rivers' annual floods. These annual floods usually occurred in the period of April-May.[134] However, the yearly water supply of both river basins shows great variability, and

[134] As a consequence only seasonal flow-irrigation could be achieved, since the summer water level was below the flood plain level. The surface of land that can be irrigated with flow(gravity)-irrigation is of course proportional to the height of the irrigation-water level above flood-plain level. Throughout the history of Mesopotamian irrigation, the two main preoccupations of the farmer were in opposition : to reduce the levels of the flood waters and to raise the water in the main irrigation canals in order to achieve flow-irrigation. The former demanded high efforts at a more regional scale than the latter.

years of high magnitude floods as well as low annual discharge can occur.[135] It is important to keep these hydrological conditions in mind when interpreting palaeo-environmental conditions. The extreme variability of the amount of silt in suspension must also be taken into account.[136]

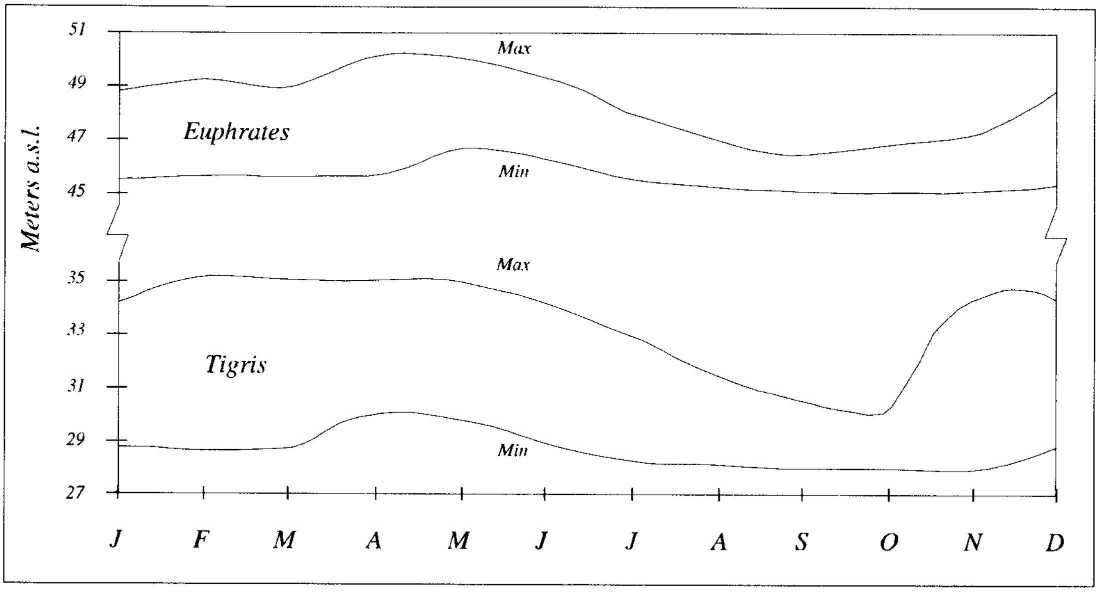

Fig. 9. Monthly Gauge Readings at Ramādi (Euphrates) and Baghdad (Tigris). Only maximum and minimum levels are shown for the period 1906-1932. Level differences are more pronounced on the Tigris (after RZÓSKA 1980, 50).

At present, flood control follows a plan adopted by the Iraqi government in 1955.[137] In order to eliminate the danger of floods and to control and regulate the water supply, storage reservoirs were built in both the Tigris and the Euphrates basins. Downstream on the Tigris, the storage reservoir of the Ṯarṯār receives floodwater via the Ṯarṯār inlet canal, just upstream from the Sāmarrā' barrage. The level of this reservoir can be regulated via the Ṯarṯār outlet canal towards the Euphrates or via the new Ṯarṯār outlet canal towards the Tigris again, just upstream from greater Baghdad (Figure 10).

The Ḥabbānīyah depression must have played an important, natural role in history with regard to the regulation of Euphrates floods downstream. Indeed, dangerous high floods of the Euphrates could discharge naturally into the Ḥabbānīyah depression via the Suteih depression downstream from present-day Ramādi, thereby diminishing the discharge

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[135] AL-KHASHAB 1958, 46 ; CHARLES 1988, 39. See also SANLAVILLE (1990, 19) for the annual discharge variability of the Euphrates in Syria for the period 1950-1963.

[136] For data, see e.g. BERRY *et al.* 1970, 132.

[137] AL-KHASHAB 1958, 35 ; BURINGH 1960 ; LEBON 1955. Not all of the proposed irrigation extensions of the so-called Haigh Commission were completed.

and danger for the low-lying flood plain [138] (Figure 10). When entering the flood plain near Fallūğah, the flood waters of the Euphrates were diverted into various flood channels, bifurcating radially towards the southeast. It is evident that such flood channels also gradually built up a kind of levee system which can be called flood levees. As such, they were formed not by the nearly annual overbanking, as in the case of natural levees, but only by the flood deposits associated with high flood years, depending on the recurrence interval. Indeed, it is not unlikely that such a flood channel can exist over a short-term period, unless the vertical accretion of its levees prevents it from further being used as a flood channel and a new one is formed. Such flood channels may have become ancient inundation canals, which can be regarded as a method, in this part of the plain, of controlling part of the Euphrates flood (LEBON 1955, 49).

A second natural outlet may have existed for the floods of the Euphrates through the Abū Dibbīs Depression on the right bank of the river just opposite the modern Laṭīfīyah Canal at the latitude of the terrace of Iskandarīyah.[139]

Before the flood control projects of the 1950s, most cultivated land was protected against floods by the method of controlled breaching. When the rivers were in flood, the river banks were deliberately breached at points where the excess water could flow over barren land (LEBON 1955, 50; and, for evidence of this practice in the Old Babylonian period, see Cole and Gasche, this volume, p. 11). In order to prevent the flooding of Baghdad at the beginning of this century, for instance, the left bank of the Tigris was breached just above the city. The flood waters passed east of Baghdad at the foot of the Diyala fan and joined this river further down. And during floods ... *the site of the city becomes an artificial island, encircled by the earthen walls which alone prevent its whole area from inundation to a depth of from 10 to 15 feet* (LEBON 1955, 51).

Unfortunately we do not have continuous medium-term observations of flood levels such as exist for the Nile (HASSAN and STUCKI 1987, 39-41). According to BURINGH (1960, 52), flood inundations could occur almost every 3 or 4 years. Evidence of historical high-magnitude floods for the Euphrates in the second millennium BC are recorded in roughly 1654, 1620, and 1580 BC (see Cole and Gasche, this volume, pp. 7-9).

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[138] According to LEBON (1955, 53) exceptional high floods could overflow further into the Abū Dibbīs depression via the Mujarrah channel between the two depressions. Presently the Ḥabbānīyah depression is, apart from being an escape, also a storage reservoir. Flood water can enter the depression upstream from Ramādi, the water level is controlled via the Mujarrah regulator and escape channel to the Abū Dibbīs depression, and stored water from the Ḥabbānīyah lake is allowed to return to the Euphrates when needed via a feeder at Ḥabbānīyah.

In fact, there is evidence that a similar system may have been functioning already in the first half of the second millennium BC. According to Cole and Gasche (this volume, pp. 11-13), it is likely that the Old Babylonian king Samsuiluna constructed an escape canal for Euphrates floodwaters into the Ḥabbānīyah depression, and then later built another canal (or a qanat-like structure) between this depression and that of Abū Dibbīs to the south (or at least he contemplated such a project).

[139] See WILLCOCKS 1917, Pl. 2, showing a passage from the Euphrates towards the Abū Dibbīs depression at the latitude of the terrace of Iskandarīyah with ... *overflow of the Euphrates in high floods*. However, according to Cole and Gasche (this volume, p. 13, n. 52), this passage is untenable from a topographical point of view.

LE STRANGE (1900, xxx, xxxi) cites major inundations of the Tigris around Baghdad in 941, 1074, 1159, 1174, and 1217 AD. This limited array of data is presented here simply to set an approximate estimation of the frequency of high-magnitude floods at 2-3/100 years [140] for both rivers. We do not have sufficient data to differentiate recurrence intervals for the Twin Rivers. However, floods of the Tigris have always been more severe.

It should be noted that besides the 'normal' flooding of the rivers and the high magnitude floods, extreme floods can perhaps also be distinguished. Recurrence intervals of such extreme events are, of course, highly variable (PETTS and FOSTER 1985, 35). Their recurrence is mainly related to the variability of intensity, duration, frequency, and type of precipitation [141] in upstream areas and complex precipitation-runoff relationships (drainage densities, interception and soil water storage capacities, vegetation cover, soil saturation, etc.) Such extreme events must have had an important influence on the evolution [142] of Mesopotamian landscape and civilization.[143] Their interpretation and impact [144] at meso-scale, however, remain hypothetical due to a lack of adequate field descriptions.

A regional synthesis of palaeoflood chronologies for the Twin Rivers should be established in order to relate it with regional and global climatic fluctuations. But establishing such a palaeoflood chronology based strictly on geomorphological surveys alone would be extremely difficult in a broad [145] and active flood plain. Furthermore, global climatic fluctuations are poorly understood.

6. THE MEANDERING RIVER FLOOD PLAIN OF THE EUPHRATES AND TIGRIS

6.1. Present Topography, Landforms, and Landscape in General

6.1.1. Present Topography

The Mesopotamian meandering river flood plain is a nearly flat region, gently sloping to the southeast with elevations varying along the Tigris from 65 m at Sāmarrā' to 19 m at Kūt ; and along the Euphrates from 60 m at Hīt to 25 m at Ḥillah. The Euphrates bank near

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140 Frequency analysis of floods requires good quality hydrological records for longer time periods. Such data do not exist for remote times, so we have to rely on indirect information from textual sources. However, the recently published Babylonian astronomical diaries can provide more insight into the hydrography of the Euphrates, especially during the second half of the first millennium BC.

141 See e.g. HUSSEIN 1996.

142 See e.g. the Early Dynastic Flood level in the Y trench at Kish (GIBSON 1972, 83ff).

143 It is illustrative that the Akkadian word for flood (*mīlu*) became in time a synonym for anarchy and disaster (ROWTON 1969, 312).

144 This may have contributed to the upheaval evident in such periods as the Kassite dark age, the Aramean dark age (11th - 9th centuries BC), the transition from the Sasanian to the Islamic period (6th - 7th centuries AD, and roughly the 10th century AD, the period of the disintegration of the Abbasid Caliphate (ROWTON 1969, 312).

145 Palaeoflood chronologies were successfully established in rather narrow flood plains based on preserved evidence of the largest floods and slackwater deposits. Such deposits are accumulated and preserved along the margins of the river valley (EASTERBROOK 1993, 105).

Fallūğah is situated about 43 m above sea level, while the plain around Baghdad and the ʿAqar Qūf Depression are around 34 m and 31 m respectively. Nevertheless, this flood plain shows a very important meso-relief [146] of depressions and levees. This relief is the combined result of sediment aggradation [147] along river channels, flood deposits during the Holocene, and cultivation/irrigation practices for a period of more than 6.000 years.[148]

This sediment accretion is well expressed in the topography east of the Euphrates between the terraces of Fallūğah and Iskandarīyah, south of Iskandarīyah along the Kutha (Nahr Ibrahim) and Babylon levees, between the Kutha levee and the present Tigris, along the Nahrawān canal, along the Dujail Canal, and also along the present natural levees of the Twin Rivers (see Figure 11). As already mentioned earlier, in this zone the natural levee of the Euphrates is at a higher topographical position than that of the Tigris. Consequently, modern irrigation and drainage canals take their water from the Euphrates and flow generally in a northwest-southeast direction across the flood plain. Figure 10 depicts only the main modern drainage canals. These canals connect the main flood basins in this area and conduct water towards the central part of the flood plain, to the so-called '*Third River*' [149] drain.

Most of the modern irrigation canals are situated on these topographically higher levees (Figure 15, and Cole and Gasche, this volume, Map 1). These levees represent former *natural levees* and/or *flood levees* associated with older watercourses of the Euphrates or Tigris ; they can also represent topographically expressed old main irrigation canals [150] that were in use over a considerable period of time ; or they can represent a combination of both. The latter are called *irrigation levees* (BURINGH 1960, 153). When the main formation processes are not clear, we will hereafter arbitrarily call these levees *topographical levees*.

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[146] See Cole and Gasche, Map 1, in this volume for one-meter contour interval topography.

[147] This accretion was of course not uniform throughout the plain. The data given hereafter are only meant as general indications. According to BURINGH (1960, 156), almost the whole flood plain of the Euphrates, Tigris, and Diyala is covered by irrigation sediments varying in depth from 0.5 m to 5 m or more. At Kish (Y trench), virgin soil is at 9 m below plain level (GIBSON, 1972, 308, Fig. 61). Above this virgin soil are layers dated to the Jemdet Nasr period. However, some tells of the same period are above plain level (GIBSON, 1972, 31). Ra's al-ʿAmiya (Ubaid period), shows virgin soil 4 m below the surface (GIBSON, 1972, 31). At Tell 'Uqair virgin soil is situated 5 m below plain level (ADAMS, in GIBSON, 1972, 198). At site 221 from Adams' Akkad survey, the Akkadian layer is at a depth of 5-6 m below plain level (ADAMS, in GIBSON, 1972, 204). At Abū Salabikh virgin soil underlying the Early Dynastic occupation was encountered at depths of between 1 and 2 meters below the level of the surrounding plain (ADAMS 1981, 347, note 5, citing POSTGATE and MOOREY 1976, 135, 141, Fig. 5). At Tell ed-Dēr (approx. founded around 4.300 BP) virgin soil is situated 3 to 4 m below present plain level (GASCHE 1985, 580 n. 2). The base of Abū Ḥabbah (Sippar) is defined at 28.5 m, which corresponds to an accretion of 5 to 6 m (PAEPE and BAETEMAN 50, Fig. 3). Mashkan-Shapir lies some 4 m below the present plain (HOLE 1994, 142).

[148] BURINGH 1960, 155 ; ADAMS 1958.

[149] This main drain between the Tigris and the Euphrates, dug in 1989 and 1990, collects the brackish water of the northern flood plain and expels it into the Gulf. Near Nasīrīyah it runs under the Euphrates by way of large tubes.

[150] The cleaning and dredging of these old irrigation canals and the silting up or collapse of disused old irrigation banks and protective dikes cause an anthropogenic levee along the canals.

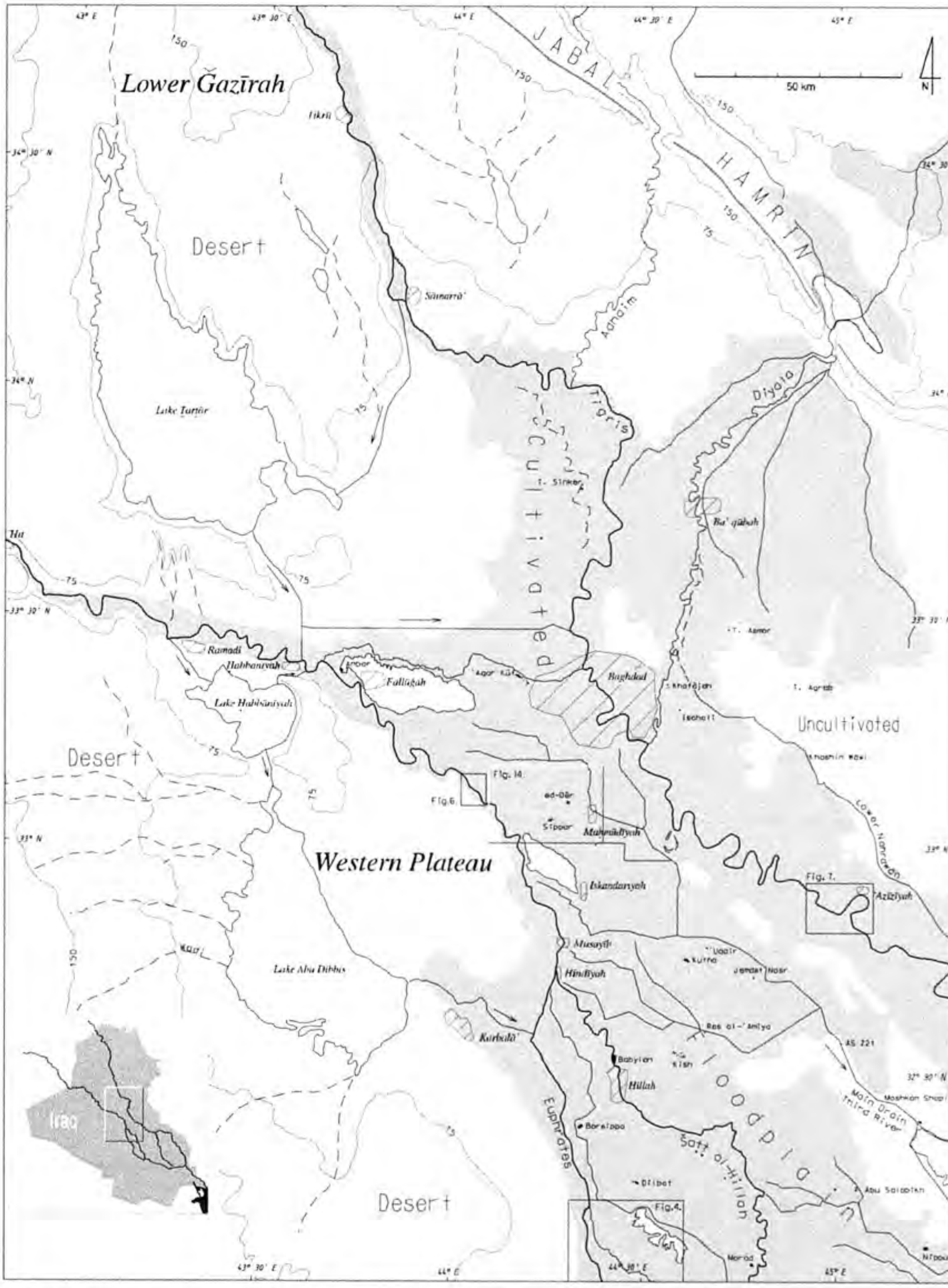

Fig. 10. General Overview of the Meandering Rivers Flood Plain. The gray area corresponds to the present cultivated flood plain. The major modern drainage canals give an indication of the main topography between the Twin Rivers. Some archaeological sites mentioned in the text are indicated. The central inset shows the localization of the study area.

The same nomenclature can be used for the depressions in the flood plain. Some depressions are natural flood basins, like the ʿAqar Qūf depression, which was in remote times a former lake and at present a large basin almost without irrigation sediments (BURINGH 1960, 172). Other depressions are *irrigation depressions*, which were originally basin depressions but are now silted up with irrigation sediments (BURINGH 1960, 156).

These main morphographic units of natural or irrigation levee/depressions have specific soil characteristics described by BURINGH (1960, 156ff) in different soil series.[151]

As one might expect in an active flood plain that is characterized by net vertical accretion, the present topography can mask or even reverse completely the original topography that existed before the formation of the main levees. However, according to Cole and Gasche (this volume, p. 14 and Map 3), the present levee system is much the same as that which existed in the first half of the second millennium BC and probably before. A very strong argument in their favor is the *...spatial distribution* [of archaeological sites which] *shows that a great number lie directly on the center part of the main levees while most of the others, located at some distance, are on appendages of the main levees... The general distribution pattern demonstrates the perenniality of the basic system, especially in light of the fact that all periods of occupation from Ubaid to Islamic are covered* [on their Map 3].

We assume that the net vertical accretion described in the previous paragraph probably started during the (early) mid-Holocene period, probably at different rates and affecting different localities. The sedimentary environment in which this accretion took place was probably characterized by a multi-channel (anastomosing) riverine landscape, reflecting the gradual transition from the more braided river pattern that existed during the Late Pleistocene period.

6.1.2. *Landforms*

6.1.2.1. *Relict Landforms*

This part of the flood plain is characterized by the single-channel meandering rivers of the Twins. In the present Mesopotamian flood plain the coarsest sediments that can be found are fine sandy deposits, since the competence [152] of the rivers is limited to the fine and very

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[151] BURINGH (1960, 148, 156) describes the *Babylon and Baghdad soil series* and *Abu Gharaq soil series* as typical for the natural levee and natural basin soils respectively. For the typical irrigation levees and the irrigation depressions, he describes the *Tamaziyah soil series* and *Ananah soil series*(BURINGH 1960, 158, 159).

[152] Defined as the ability of a current of water to transport sediment, in terms of particle size rather than amount (capacity). It is measured as the diameter of the largest particle transported as bed load. This is mainly a function of the bed velocity. It should be noted that contrary to intuition, particles smaller than fine sand are difficult to erode ; because of cohesion, such fine particles tend to stick together and therefore the most-movable sediment is fine sand (FRIEDMAN *et al.* 1992, 245). However, once these fine particles are in suspension they remain longer in suspension at lower velocities than their entrainment velocities (Hjulström effect).

fine sand fractions (BURINGH 1960, 145, 151). Landforms that consist of coarser sediments are therefore relict landforms, like the fluvial erosion terraces of Iskandarīyah and Fallūğah. The gravelly and gravelly-sandy materials of these landforms are associated with Pleistocene palaeo-discharges of a higher magnitude. Their topography and texture in general decreases towards the southeast. In origin these landforms can perhaps be attributed to Pleistocene alluvial fans deposited by braided river systems.

These Pleistocene terraces and the reworked or redeposited sandy outcrops of terrace material [153] have a high content of secondary gypsum. The terraces occupy the highest topographical position in the study area, and are distinct mesa-like morphological features with a maximum height of 10 m above the plain and well developed escarpments.

The sandy outcrops are irregularly spread over the area south of the Fallūğah Terrace. They are situated at topographical positions near the flood plain level, or they are covered by irrigation sediments. Although sometimes situated only a few decimeters above the level of the plain, they are clearly distinguishable in the field due to the good internal drainage conditions. Their localization is indicated on Figure 11. The Kassite capital Dūr-Kurigalzu (ʿAqar Qūf) and Baghdad International Airport are situated on such sandy outcrops.

Figure 12 shows the cumulative probability graphs of the decalcified sand fraction of three samples taken from relict terrace material. AQ PA is a sample taken from the sandy gravel layer 3.5, sondage A at Abū Qubūr North (see DE MEYER and GASCHE 1986, 8, 11). Median size of the sand fraction is medium sand and graphic standard deviation is 1.00 ϕ. This graphic standard deviation is a measure for the sorting of the sediment and corresponds to moderately sorted material (LINDHOLM 1987, 171). FalT1 corresponds to a surface sample from the Fallūğah Terrace. This gravelly to sandy-gravelly deposit has a median sand size fraction of fine sand and a graphic standard deviation of 0.91 ϕ (moderately sorted). Finally, RT1 corresponds also to a surface sample of an outcrop of reworked loamy sandy terrace material, situated a few meters above plain level, 25 km downstream from Fallūğah. Its sand fraction is very similar to that of the Fallūğah Terrace itself and is also moderately sorted (0.78 ϕ). Far too few samples were taken and field observations made to interpret these reworked terrace outcrops in more detail, and some sandy to gravelly-sandy deposits in the flood plain suggest a far more complex sedimentary history.[154] However, until further field work can be done, we will interpret these deposits as reworked and redeposited sediments of upstream Pleistocene terrace material under different fluviatile conditions than those that exist today.

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153 The reworked or redeposited terraces are generally loamy sand in textural class.

154 See DE MEYER and GASCHE (1986) for a description of sandy to gravelly-sandy fluviatile surface deposits at Abū Qubūr North in sondage B, two meters above plain level. These deposits contain Akkadian to Neo-Babylonian potsherds, imbricately stratified, and are attributed by the authors to violent inundations (DE MEYER and GASCHE 1986, 15).

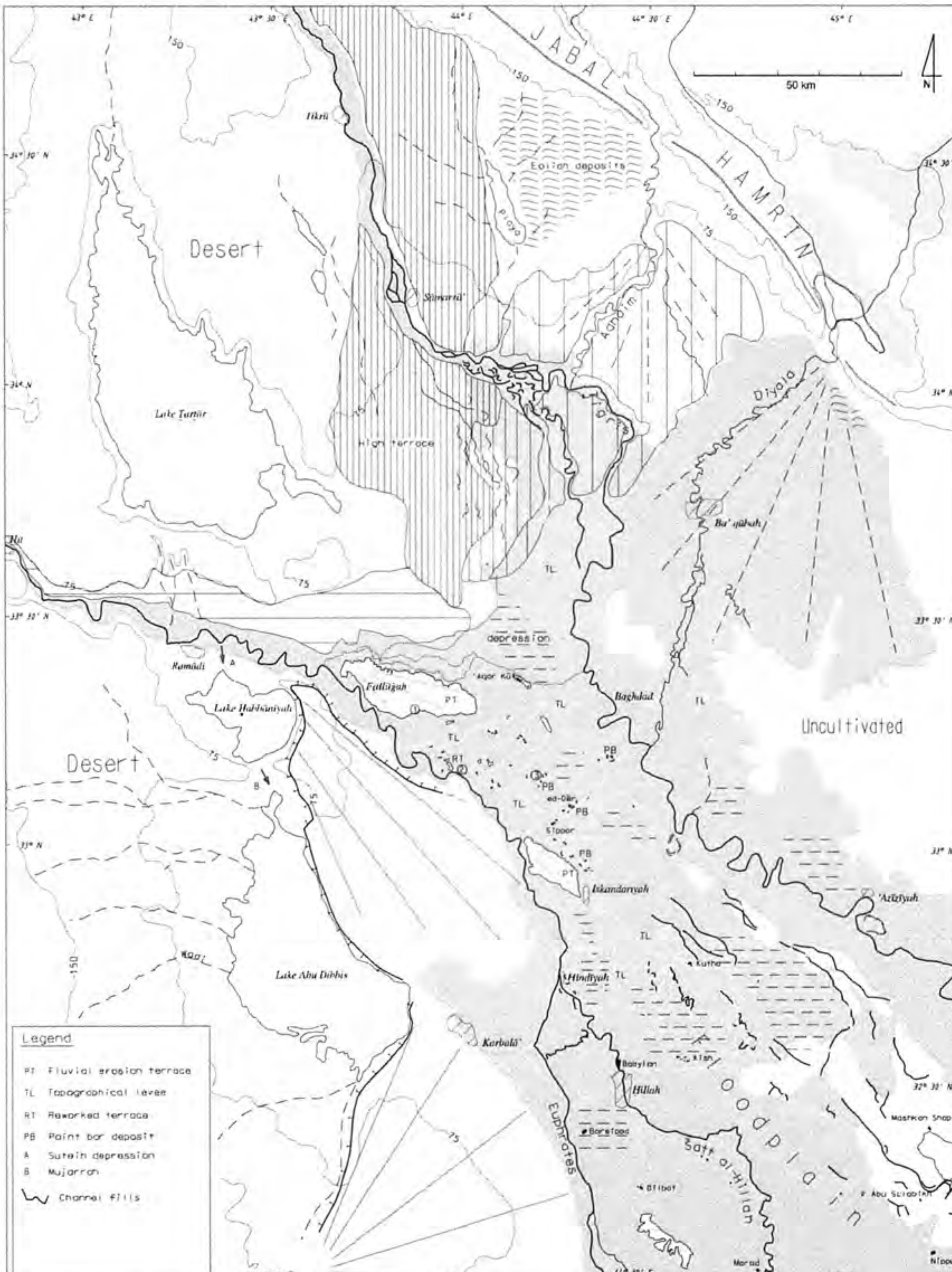

Fig. 11. General Macromorphographical Map of the Mesopotamian Meandering Rivers Flood Plain. Localization of samples for granulometric analyses (see Figure 12) : ① = Pleistocene terrace FalT1 ; ② = Reworked terrace RT1 and ③ = AQ PA. Compiled after various sources.

It is still not clear how the Pleistocene terrace deposits in the flood plain are related to the gypsiferous, gravel deposits of the Western Plateau, west of the Euphrates. Although they are mapped as Tertiary deposits on the geological map [155] of Iraq, their morphology and superficial sediments are quite similar to those of these terraces. They might be reworked as alluvial fans attributed to Pleistocene palaeo-flows of the Western Desert.

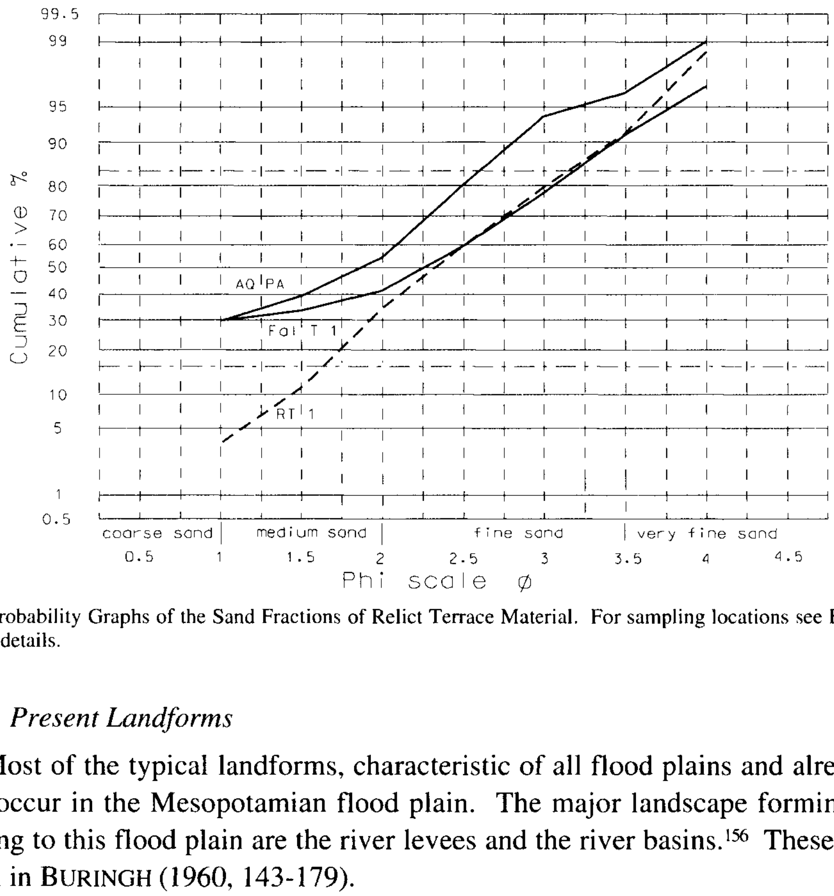

Fig. 12. Probability Graphs of the Sand Fractions of Relict Terrace Material. For sampling locations see Figure 11. See text for further details.

6.1.2.2. Present Landforms

Most of the typical landforms, characteristic of all flood plains and already described above, occur in the Mesopotamian flood plain. The major landscape forming phenomena belonging to this flood plain are the river levees and the river basins.[156] These are discussed in detail in BURINGH (1960, 143-179).

The present river levees of the Tigris and the Euphrates form a broad belt situated a few meters above the flood plain. The Tigris has built up a broad levee which forms a huge ridge rising 3 to 5 m above the plain. Notwithstanding the higher topographical position of this levee, the mean water-marks of the Tigris are below the plain level, making gravity

[155] The Western Plateau between the Euphrates and the Abū Dibbīs depression is indicated as a Miocene Middle and Upper Fars formation ; southeast of this depression the Miocene/Pliocene Dibdibba formation of sandy gravels has a distinct triangle fan planform clearly visible on satellite imagery, with one edge bordering on the Euphrates flood plain (JASSIM *et al.* 1986). This edge gently dips towards the Plain, whereas the two other edges of this triangle form clear escarpments suggesting tectonic activities. PAEPE (1971, 15) gives a profile section of this latter unit where the top 10 meters are Quaternary gravels and sand, showing cross-stratifications at the interface with the Tertiary silt material.

[156] BURINGH 1960.

irrigation without 'modern' lift irrigation techniques difficult. It was only during the Seleucid and Parthian periods that economic life shifted to the Tigris (according to GIBSON 1972, 24). The river bed of the Tigris in the study area seems to have been less liable to major course changes in historical times than that of the Euphrates. This is also the conclusion reached by Cole and Gasche (this volume, p. 17, and Maps 8-9), who have demonstrated that the Tigris at this latitude must have followed a course during the second millennium BC that more or less corresponded with its modern one. The levee of the Euphrates, on the other hand, corresponds to a belt of minor dimensions, and generally speaking we can say that the Euphrates system shifted westward in steps toward its present course at the rim of the Western Plateau.

In the meandering river flood plain, the gradient of the Euphrates between Fallūğah and Hindīyah is 0.1m/km, whereas the gradient of the Tigris between Baghdad and 'Azīzīyah is only 0.065m/km (Figure 13). Sinuosity indexes [157] are respectively 1.24 and 1.74, which classify the Euphrates as a *sinuous*, single-channel type and the Tigris as a *meandering*, single-channel type (MORISAWA 1985, 100). The mean meander belt width of the Tigris is twice that of the Euphrates and, as is obvious on any map, the amplitude and wavelength of the Tigris meanders greatly exceed those of the Euphrates.

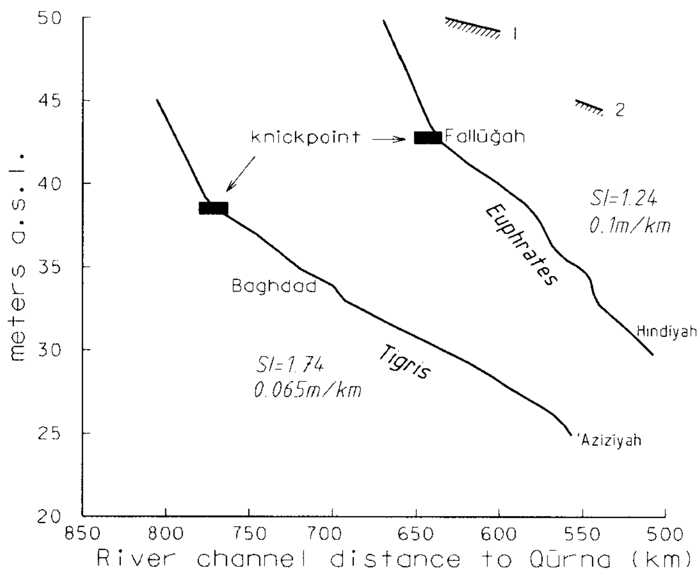

Fig. 13. Gradient of the Euphrates and the Tigris, Expressed in Channel Distance to their Conjunction. In our study region, the Euphrates has a steeper gradient and a higher topographical position than the Tigris. *SI*=Sinuosity Index. Note the confirmation of the general relation between SI and gradient: the lower the gradient, the higher the sinuosity of meandering rivers. 1 = Fallūğah terrace ; 2 = Iskandarīyah terrace.

[157] Here defined as the ratio between river channel length and the length of the central axis of the meander belt.

The width and depth of both rivers [158] (at the latitude of Baghdad) depend on the seasonal discharge and morphology of the channel bed. Here the width for both rivers varies around 250 m, whereas the depth of the Euphrates ranges from 5 to 8 m and the depth of the Tigris from 10 to 15 m (RZÓSKA 1980, 49).

The general characteristics of the river levees are their relatively coarse texture (fine sand to silty clay loam,[159] with the texture usually getting coarser with increasing depth); their higher topographical position in relation to the river and the basins (2 or 3 m above the basins); the relatively good physical condition of their soils; and their relatively shallow groundwater table (which fluctuates with the water level in the river channel and depends locally on the vertical variability of the texture). As a result of the natural drainage to the basins and the finer texture of the basin soil material, the soils on the levees are well drained. This makes the levees preferential locations for cultivation and settlement due to the absence of salinization. However, typical for the levees is the irregular occurrence of saline spots on the top convexity near the river channel and along both sides. Due to both the capillarity of the soil and the morphology of the levee, the groundwater table on the top convexity can be only 1 to 1.5 m below the surface in places, which results in the formation of a saline crust.

Several major depressions exist and can be traced by following the main drainage canals. The Maḥmūdīyah main drain and the Abū Ghraib main drain approximate the boundary of drainage and deposition of sediment between the Euphrates and Tigris systems. The river basins occupy the largest proportion of the area comprising the flood plain. The landscape and physical soil conditions gradually change from uniform levee units to the basin units. The general characteristics of river basins are their fine texture (silty clay loam, silty clay, and clay) with up to 70% clay particles, their low topographical position, and their high groundwater table, resulting in poorly drained, sometimes waterlogged, soils and the presence of saline or strongly saline soils.[160]

More typical of the flood basins of the Mesopotamian plain are the gilgai relief or bad-structured depression soils and the salinization (HARRIS 1958). However, this salinization is not restricted to the depressions alone. As mentioned above, on the top convexities of levees — irrigation levees [161] in particular — salinization can be extremely severe due to the high groundwater table and seepage [162] (BURINGH 1960, 155).

Of particular importance for the reconstruction of the Mesopotamian palaeo-landscape are the abandoned channel fills and associated point bar deposits in abandoned meanders.

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158 As mentioned already before, accurate and precise data are rare. Multi-temporal data on discharge, sediment load (amount, type, and characteristics), and river morphologies (cross-sectional area, river bank material, river bedform, pattern, gradient) at different spots along the river are minimum requirements for any geomorphological research on river channels.

159 USDA textural classes are used here.

160 BURINGH 1960, 162.

161 The so-called *puffed solonchak* soils, which are typical for the irrigation levees, argubs, and tells in Iraq (BURINGH 1960, 163).

162 Along both sides of the Šaṭṭ al-Ġarrāf this salinization process due to seepage on both sides of the levee is clearly visible on multi-spectral satellite imagery.

Fossil meander traces have been mapped, based on aerial photo interpretation [163] by GASCHE (1985, 581). Most of these meanders are located on the topographical levees, although some of them are situated in the present flood basin context. Their localization is indicated in Figures 11 and 14. Such fossil meander traces are evidently indicative of palaeo-river patterns or watercourses. Some of these traces have been the subject of more detailed geomorphological research. BAETEMAN (1980) identified the fossil meanders on the topographical levee southeast of Tell ed-Dēr as point bar deposits formed by an ancient branch of the Euphrates. The author identified point bar-like deposits of minor magnitude just southwest of Abū Qubūr in a present flood basin context (Figure 11). It should be noted, of course, that not all meander traces visible on aerial photos can be directly connected with natural channel bed deposits. A similar meandering pattern can be found at the free-flow end of irrigation canals or can be attributed to flood gully strips (BURINGH 1960, 162). More detailed fieldwork is needed to interpret these traces more definitively.

Although no distinct and continuous eolian region appears in our study area, minor eolian deposits and wind erosion features are recognizable in the field.

6.1.3. Landscape and Irrigation Patterns

Between the present rivers, the landscape is crisscrossed by remains of old diachronous irrigation canals. The remains of these primary [164] irrigation canals for the area south of ʿAqar Qūf and north of Kutha have been mapped by Gasche based on aerial photos from the 1970s (Figure 14). A comparison with satellite images from the 1990s shows that most of these remains in our study area have been leveled during construction of modern irrigation/drainage projects.

As mentioned before, these vestiges reflect irrigation units that were functional at different time periods, sometimes superimposed one upon another. Some of them were still in use at the end of the 19th century AD.[165] One functional unit of such an old irrigation canal usually takes the form of two parallel irrigation walls (argubs), wider at the main canal off-take, oriented nearly perpendicularly to the main watercourse, and directed towards the lower lying areas. In order to raise the water level in such canals, cross-regulators must have been used. However, the precise functioning and maintenance of such systems in relation to the watering of the fields is still unclear, as is their relative dating. We can suppose that these systems needed regular cleaning and dredging due to siltation of the canals, which was a factor that largely contributed to the gradual accretion of the canals but in a certain way was also beneficial for their use as flow-irrigation canals. However, when such canals grew

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163 See Figure 3 in Cole and Gasche in this volume. Where these traces are not cultivated the typical perennial weed Tamarix (Tarfa) is characteristic.

164 According to the definitions of PEMBERTON *et al.* 1988, 209.

165 On the Bewsher map, the area around present Maḥmūdīyah was a main zone of cultivation and irrigated by a single canal from the Euphrates that was 35 km long.

too high, a new canal was constructed parallel to the old one (KING 1915, 170). This resulted in a specific topography, as is evident from Figure 14.

In order to understand the ancient landscape, a profound knowledge of the extent, nature, and dynamics of the palaeofluvial systems is necessary, as is an understanding of the ancient irrigation systems. With regard to the irrigation system we must consider the spatial-functional unit in time of water capture, storage, transport, and the flooding of fields, as well as time-spatial relationships with other irrigation systems. Our knowledge of both the irrigation systems themselves and their evolution in history remains fragmentary. The study of these topics is of utmost importance, but it is made difficult due to the lack of relevant data or cartographic material, and last but not least, by the enormous infrastructural changes of the modern Iraqi landscape due to the implementation of master irrigation and drainage projects.

Surely the Mesopotamian landscape is a complex environment resulting from an interaction of natural and anthropogenic conditions. The processes of formation are still not very well understood, since it remains difficult to disentangle the natural and anthropogenic factors.

6.1.3.1. Islamic Canals

The same general planform configuration [166] of the modern irrigation canals can be found during Early Islamic and later times, as described by LE STRANGE (1905, Map II). This interpretation of the medieval situation, in our opinion, is highly informative, since it reflects in a general way the patterns of irrigation that were outlined certainly already as early as Parthian/Sasanian times (and much earlier, according to the conclusions of Cole and Gasche elsewhere in this volume) and that existed without major modifications to pre-industrial times.[167] Occupation density, landscape modification, and land-use intensity must have been quite considerable during this time span.[168]

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[166] Probably from at least Neo-Babylonian times, the area between the two rivers has been irrigated by left-bank canals fed from the Euphrates. See also the conclusions reached by Cole and Gasche elsewhere in this volume (specifically pp. 32-35, and Map 9).

[167] It seems that irrigation here reached a great extent during the Sasanian period (GIBSON 1972, 24). Under the Abbasid Caliphate, the irrigation system was initially well maintained but gradually became neglected. After the Mongol invasion, in the middle of the 13th century, the irrigation system collapsed and was left unrestored by the Ottoman Turks (WHYTE 1961, 108).

[168] We have for the area delimited by the Twin Rivers, the latitude of ʿAqar Qūf, and the latitude of Iskandarīyah (approximately 2500 km^2) only very limited site survey data (the so-called 'Akkad Survey') (ADAMS 1972). The distribution of tells in this area, however, is very dense and strongly related with the main irrigation patterns. Although for the 'Akkad Survey' the Parthian period represents the highest site-occupation value and, together with the Old Babylonian period, the highest percentage of reoccupied or newly founded sites, we have the impression that the occupational densities of the Sasanian to Late Abbasid periods have been strongly underestimated. But the reader should take note that it is difficult to draw definite conclusions about old settlement patterns here, since the diagnostic sherds utilized by Adams in this survey are not always characteristic of the periods which they are supposed to represent (see Cole and Gasche this volume, pp. 1-2, n. 2). Nevertheless, as is evident from aerial photographs from the time before

The main irrigation canals that transversed the flood plain from the Euphrates towards the Tigris are depicted schematically by LE STRANGE (1905, Map II). It must be stressed that his reconstructions remain hypothetical, and that the Arabic, Talmudic, and Classical sources are in critical need of re-examination.[169] Nevertheless, from north to south, he distinguished the following canals :

- The Dujail (Little Tigris). This canal left the Euphrates 60 km downstream from Hīt (presently near Ḥabbānīyah) and was originally a canal from the Euphrates to the Tigris (LE STRANGE 1905, 65, 51). In the beginning of the 10th century its western part had become silted up, and its eastern course and lower course were integrated into a new Dujail canal that short-cutted the Tigris below Kādisīyah and irrigated the area northwest of the Tigris upstream from Baghdad.[170] The older Dujail canal must have run along the approximate line of the present Nahr Saklawīyah[171] or Dulaim drain.

- The Nahr ʿĪsā (redug in the 12th century). This canal left the Euphrates below Tell Anbār (near present-day Fallūğah) and flowed into the Tigris by way of various branches, below the Round City (LE STRANGE 1905, 30, 66). It was the first navigable canal from the Euphrates into the Baghdad area. From the left bank of the Nahr ʿĪsā, the Ṣarāt canal branched off and ran parallel to the former, before pouring its water into the Tigris below the Round City (LE STRANGE 1905, 66). This system fed West Baghdad by that time. The Nahr ʿĪsā may have run along the approximate line of the present-day Abū Ghraib North irrigation canal.

- The Nahr Ṣarṣar. This canal branched off from the Euphrates 15 km below present-day Fallūğah and flowed into the Tigris 20 km upstream from Madāin (Ctesiphon). This canal was navigable (LE STRANGE 1905, 67). At the crossroad of this canal and the route to Mecca was situated a town that also bore the name Ṣarṣar. This canal may have followed the approximate line of the modern Abū Ghraib South irrigation canal.

- The Nahr al-Malik. This canal began 25 km downstream from the off-take of the Nahr Ṣarṣar, at a village called Fallūğah, and flowed into the Tigris 15 km below Madāin. At the crossroad of this canal and the route to Mecca was located a town called Nahr al-Malik. The road distance from this town to Ṣarṣar was around 11 km (LE STRANGE 1905, 68). The path of this canal can perhaps be associated with the modern Yūsufīyah canal.

- The Nahr Kutha. Its point of origin on the Euphrates was 15 km below the off-take of the Nahr al-Malik, and its confluence with the Tigris was about 50 km below Madāin. Its location may coincide with the Ḥabl Ibrāhīm (LE STRANGE 1905, 69).

All these canals can be located on the most prominent topographical levees[172] in the flood plain under consideration, except for the old Dujail canal. Some of them were probably constructed on existing natural levees. However, one might suspect that these canals at least contributed to the accretion of these levees.[173]

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the modern waterworks, the landscape is criss-crossed with irrigation canals that must have been partly in use in a not so remote past.

169 The implementation of such a research project is in fact planned within the framework of a 'Interuniversity Poles of Attraction Programme — Belgian State, Prime Minister's Office — Federal Office for Scientific, Technical and Cultural Affairs.'

170 See also WILKINSON 1990 and above.

171 LE STRANGE (1905, 69) places the Nahr ʿĪsā in the vicinity of the present Nahr Saklawīyah.

172 The problem of localization of these canals is of course more complex and will be investigated in much greater detail, from different textual viewpoints, within the framework of the above-mentioned research program.

173 It is a well known phenomenon in the construction of irrigation canals that, downstream from bifurcations, deposition occurs. Since the sum of the sediment transport capacities of two daughter canals is lower than

Prior to the construction of these canals in a more remote time, the Euphrates in flood, upon entering the flood plain, probably discharged its waters into various anabranching flood channels. Such a dispersal of stream power over different channels causes deposition and the formation of flood levees. These flood channels were probably utilized later as an early method for controlling part of the Euphrates flood and for utilizing the water for irrigation (LEBON 1955, 49). Gradually such flood channels were reinforced by bank protection and canal modification. As such, the topographical levees are probably hybrid in origin but, as already pointed out above, estimations of the relative importance of natural and anthropogenic processes are highly hypothetical.

6.1.3.2. Irrigation Patterns before the Modern Waterworks

LEBON (1955) described the recent irrigation patterns before the onset of modern flood control projects during the 1950s. His descriptions of the main irrigation canals branching from the Euphrates upstream from the Hindīyah barrage is illustrative of the functioning of the pre-modern irrigation canals. A brief description is justified here since its functioning also has a direct consequence on the sedimentation that might occur along these canals.

The Hindīyah barrage was constructed in 1891 in order to maintain the water level in the Šaṭṭ al-Ḥillah and was restored by Willcocks in 1925 (LEBON 1955, 52, 53). The canals issuing upstream from this barrage were subdivided into three types. The four canals [174] just upstream from the barrage were *perennial canals* that assured irrigation the whole year round. The canals [175] further upstream were in *semi-perennial* use. The water level in these was controlled to a lesser extent by the barrage, and a limited amount of water could be admitted into them in the summer. This allowed more land to be irrigated in this season, while in the winter the high water level permitted its full use. The canals even further upstream were *inundation canals.*[176] All the water required for the land could usually be admitted into them in winter, but in summer the level was to low (LEBON 1955, 53).

Presently the Euphrates supplies several major channels bringing irrigation water to the flood plain. From north to south the main irrigation canals are the Saklawīyah, Abū Ghraib (subdivided further into the north and south canals), Radhwanīyah, old and new Yūsufīyah, Laṭīfīyah, and Iskandarīyah canals.

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the sediment carrying capacity of the mother canal, these bifurcations are preferential places for deposition. Processes are comparable here : the sediment load of the Euphrates was distributed by way of different canal off-takes. These transverse canals must have been in use for at least more than a half millennium. In 1345 AD, all but the Nahr ʿĪsā seem to have silted up (GIBSON 1972, 25). The Nahr ʿĪsā was navigable again in 1837 (GIBSON 1972, 25). On the 'Bewsher' map the Nahr Malcha (= Nahr al-Malik) still clearly displays its meandering pattern (SELBY, W.B., COLLINGWOOD, W., BEWSHER, J.B., 1885 *Surveys of Ancient Babylon and the Surrounding Ruins with Part of the River Tigris and Euphrates ... in 1860 to 1865,* London, 6 sheets published in 1885, British Museum).

174 On the left bank these were the Ḥillah branch and Kifl Canal, and on the right bank the Beni Hassan and Husseinīyah canals.

175 These were all left-bank canals : the Musayyīb, Nasīrīyah, and Iskandarīyah.

176 These include from south to north the Laṭīfīyah, Yūsufīyah, Abū Ghraib, and Saklawīyah canals.

6.1.4. General Landform and Landscape Evolution

6.1.4.1. Long- to Medium-term Landform Evolution

NIJS (1987, 5) briefly divided the general geomorphological history of our area into three main events. He distinguished at first a period of deposition of thick fans of coarse sand and gravel all over the area brought into the plain by a Pleistocene braided river pattern. Second there was a period of net erosion and dissection as a result of falling sea-levels and third a new large-scale sedimentation of finer material at the beginning of the Holocene whereby ... *the rivers gradually adapted to the new situation by shaping the present alluvial plain*. We can refine this picture of river adaptation by that already briefly outlined above : there was a gradual transition from a more anastomosing or multi-channel river pattern towards a single-channel meandering system. This implies that at a certain moment synchronous channels existed that were gradually abandoned due to siltation. Such a general evolution probably occurred at higher rates during the first half of the second millennium BC,[177] although the documentary record indicates that there were still three functioning natural channels in the Sippar region as late as a century after Hammurabi and that this transition to a single-channel meandering system was finally completed by no later than 900 BC.[178] Textual evidence from the time of Hammurabi in particular displays a picture of siltation of watercourses on the one hand and increasing flood danger on the other (see Cole and Gasche this volume, pp. 7-10). This could be explained by the siltation of some of the synchronous branches, thereby increasing the discharge in the fewer remaining active channels. The reasons for such increasing rates of siltation can probably be found upstream in the river system (see again Cole and Gasche this volume, pp. 10-11) and probably did not affect the palaeo-watercourses of the Twin Rivers at the same time. This process of siltation and the gradual vertical accretion of the natural channel beds probably started already during the early (mid)-Holocene period and varied in rate and location. As one might expect, flood plain accretion rates are highly variable in both space and time,[179] being related to local topographic position, the nature (frequency, duration, location) of individual flood events, water and sediment supply, the vegetation cover, and the nature of the river banks.

Indeed, the lower topographical position [180] of the Tigris levee, although it constitutes a broad natural levee in this area, is somewhat surprising. At present, its water discharge,

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177 It is generally accepted that the geomorphic work done on the landscape is the highest during a more humid period just after a period of aridification, since the vegetation density is the lowest, causing accelerated soil erosion and high sediment yields in the rivers (PETTS and FOSTER 1985, 182). Such a period of aridification is attested around 3.800-3.500 BP in the upstream area of the flood plain (COURTY 1994, 51 ; OTTERMAN and STARR 1995) and around 4.200 BP (DEMENOCAL *et al.* 1998, 31).

178 Cole, personal communication. See also Section 7.5 below (Conclusions and General Working Hypothesis) and Cole and Gasche in this volume (especially pp. 16-27, 32, and Maps 8-9).

179 For our study area estimations of flood plain accretion rates are given on the order of 40 cm/1000 years for the flood basin and 1.5 m/1000 years for the levee (GASCHE 1988, 42, 43). World average rates of flood plain accretion range from virtually nothing to as much as 91 cm/year. In the Indus plain of Pakistan a substantial proportion of the accretion occurred only in the early Holocene (GOUDIE 1995b, 117).

180 See e.g. ARRIAN, Anabasis Alexandri, VII, 7, 3-4.

annual sediment load, and sinuosity are higher than that of the Euphrates. These factors normally favor vertical levee formation, and if, as Adams notes ... *the available evidence makes it seem likely that the heaviest net increment, as well as current rate, of deposition occurs not in swamps in the south but at the northern end of the alluvial plain* (ADAMS 1981, 10), one may ask why the present Tigris did not build up a higher levee? Factors that might explain its lower position can be found in the structural asymmetry of the geosyncline, whereby the Tigris followed the lowest depressions [181] and built up its natural levee gradually between these confined limits, in the broader levee itself, or in the finer sediment load of the Tigris. Another factor may be the existence of the Nahrawān Canal, already mentioned before (Figure 10). This canal follows a huge topographical levee, east of Baghdad and parallel with the present Tigris. It was perhaps functional for less than a millennium, gradually silted up, and was abandoned around the 12th century AD (LE STRANGE 1905, 59). In extent this topographical levee is comparable with that of the Euphrates, and as such is anomalous. It might seem reasonable to accept that a large amount of the Tigris sediment load was diverted and deposited to form the topographical levee on which the later Nahrawān was constructed. Still other explanations can be found in attributing a relative young age to this reach of the Tigris. Another plausible explanation, suggested by Rowton, can be found in the differences of the sediment load. He argues that deforestation [182] in the Euphrates catchment area occurred long before the deforestation in the Tigris area and that for a long period the Tigris carried much less sediment (ROWTON 1969, 316).

6.1.4.2. Short-term Landscape and Landform Evolution

An estimation of the relative contributions and rates of the two different processes (e.g. natural levee and anthropogenic levee formation) in the final topographical expression is of course essential for the interpretation of the formation of the Mesopotamian landscape. However, in many instances differentiation between the processes is problematic. There are no textural differences among the deposits; faunal remains are the same in the two watercourses; and spoil banks may be interwoven in natural levee deposits, which can be used again later as a higher foundation for a new main irrigation canal. It is the author's experience that even with a detailed screw-augering transect, without the evidence of

[181] The structural asymmetry of the geosyncline is best visible in the bathymetry of the Gulf (BALTZER and PURSER 1990, 177). Since the Mesopotamian Plain is the northward extension of this geosyncline, we might expect a similar configuration for the area discussed here. Since the deeper parts are located near the eastern borders of the flood plain, it must have influenced mainly the flow-constraints of the palaeo-Tigris. This asymmetry could also explain the general trend of Euphrates hydrography towards the Tigris. Note that the area on the west side (and partly on the east side) of the Tigris can be viewed on meso-scale as one big depression: ʿAqar Qūf depression + depression north of ed-Dēr + Seleucia depression + Jemdet Nasr depression.

[182] According to Rowton, deforestation in the catchment area of the Euphrates occurred during the Early Dynastic period and accounted for a marked increase in the amount of sediment load (ROWTON 1967, 263). This deforestation (and the erosion) was a gradual process all through the third and the second millennia BC (ROWTON 1967, 277).

sedimentary structures in a well chosen profile section, interpretation remains difficult. It is only by way of a multi-disciplinary approach, combining textual evidence, geoarchaeological and sedimentological research, available maps and multi-temporal and multi-spectral imagery, etc., that these complex phenomena can be disentangled.

In some cases the predominance of one process over the other is evident. If, for example, the planform is rather straight, deviating from the general topography and with remains of irrigation banks and settlement alignments on the top convexity, we can, even without ground-truth verification, assume the existence of an irrigation canal. This is the case with the 8th century AD Šaṭṭ al-Nīl, which crossed the flood plain in a west-east direction from the Euphrates just north of Babylon towards a point close to the present Tigris (ADAMS 1981, 219, Fig. 47). Surely, the western part of the Šaṭṭ al-Nīl took advantage of a formerly existing topographical (probably a natural) levee, but continued to build an irrigation levee further eastwards, now intersected by the 'Third River.'

Here we come to the other main problem : the estimation of the rates of topographical levee aggradation. In the case of the Lower Nahrawān, which runs on an enormous topographical levee, we may assume an underlying natural levee system. But we have limited information about the aggradation of this irrigation system when it was functional.

7. THE STUDY AREA AND TRANSECT DESCRIPTION

7.1. General Geomorphological Settings and Former Geomorphological Research

The study area in which the auger transect is located is arbitrarily delimited by the availability of topographical maps of scale 1/10.000 and satellite images (SPOT panchromatic). It comprises the area between the geographical coordinates of 44° 09' - 44° 20' E and 33° 00' - 33° 10' N (Figure 14).

This area is situated 20 km southwest of Baghdad and is bordered by the present Euphrates and the gypsiferous, gravelly terrace of Iskandarīyah on the south. It is situated in that part of the Mesopotamian flood plain where the river courses of the Tigris and the Euphrates are separated by a distance of less than 50 km. This area is therefore important for the understanding of the hydrological and fluviatile conditions of the whole Mesopotamian Plain lying to the south. The landscape displays a typical levee/flood basin context of a flood plain.

Central and dominant in the study area and running roughly from west to east is the topographical levee along which Tell ed-Dēr and Abū Ḥabbah (Sippar) are situated. The summit of the levee can be followed by the modern irrigation canals of Yūsufīyah (Figure 14). This levee was recognized as a natural one in the very first geomorphological surveys of this area (PAEPE 1971, 21).

Here it must be stressed that geomorphological research in this region has not yet been detailed enough to allow other than tentative conclusions to be drawn about the ancient

fluviatile system on the basis of these data alone. The following summary of previous research should be read with this in mind.

Based on field observations and aerial photos PAEPE (1971, 23) mapped the *filled gullies* (abandoned channel fills) in this area and concluded that the channel fills ... *parallel to the* (present) *Euphrates are successive stages of its retreat towards the west. The shifting of the riverbed went along with the steady filling up and subsequent heightening of the riverbed to the level of the Euphrates....* However, for the natural levee between Tell ed-Dēr and Abū Ḥabbah, he had the idea *that they were former stages of location of the Tigris* (PAEPE 1971, 24), and that this north-south flow of the Tigris through Tell ed-Dēr and Abū Ḥabbah shifted eastwards as a result of the Euphrates sedimentation and thereby reversing the present topography. He also stated that ... *it is sure by now that the Euphrates chased the Tigris out of the Mesopotamian plain as a result of the former's higher sedimentation rate and subsequent heightening. Thus Euphrates floods must have faded out, buried or captured older Tigris channels* (PAEPE 1971, 26).

This fluvial system between Tell ed-Dēr and Abū Ḥabbah was later the subject of a more detailed augering program by Paepe and Baeteman. They unraveled the existence at certain depths of levels of different *flood phases* and brought them in relation with the settings of the archaeological sites. They concluded that ... *the plain between Tell ed-Dēr, Abū Ḥabbah and Maḥmūdīyah is an alluvial deltaic-crevasse area dominated by three central gullies along which the tells are situated* (PAEPE and BAETEMAN 1978, 55).

These central gullies are, in the area around Tell ed-Dēr and Abū Ḥabbah, associated with three superimposed 'flood systems' and were named : A-system (oldest), B-system, and C-system (PAEPE and BAETEMAN 1978, 39). Based on the pattern of these systems, they concluded that ... *the flooding occurred from north to south, which means from Tigris to Euphrates in the present area* [region of Tell ed-Dēr and Abū Ḥabbah] (PAEPE and BAETEMAN 1978, 45).

The A-system [183] is characterized by lithological units which consist generally of green-gray fine sands, locally outspoken coarse and even gravelly. The top of these units is situated 5 to 7 m [184] below present plain level (=33 m) (PAEPE and BAETEMAN 1978, 39). These units are associated with channel deposits ('A-sands') and are, according to PAEPE and BAETEMAN (1978, 40-41), ... *not to be considered as patterns of one single streamgully. It is the ultimate configuration of several superimposed meandering streampaths with crevasse-splay* [185] *areas as is revealed in the usual lithological complexity of a boring-log.*

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[183] At Tell ed-Dēr this sterile unit is situated below the archaeological layers and is labeled A11 (PAEPE and BAETEMAN 1978, 39). These deposits are associated with the natural levee deposits of a river course between Tell ed-Dēr and Abū Ḥabbah (PAEPE *et al.* 1978, 21). They are relatively dated and are not younger than 4.000 BP (PAEPE and BAETEMAN 1978, 41 ; PAEPE *et al.* 1978, 22, and Table 1).

[184] The bottom of these units was not attained, but the minimum thickness was around 1 to 2 m (PAEPE and BAETEMAN 1978, Fig. 1).

[185] One crevasse-splay (flood-plain splay) was identified immediately southeast of Tell ed-Dēr and extended more than 4 km in a southeasterly direction (PAEPE and BAETEMAN 1978, 41, and Map of the fluviatile

A central gully belonging to the A-system between Tell ed-Dēr and Abū Ḥabbah was identified and associated with ... *a river course whose "talweg" connected both towns* (PAEPE *et al.* 1978, 21). The bases of Tell ed-Dēr and Abū Ḥabbah were established on these deposits (PAEPE *et al.* 1978, 21). This central gully in the A-system was interpreted to be the basis of a natural levee and shows a continuous sedimentation series of coarse sands without interruption by any of the later flood systems (PAEPE and BAETEMAN 1978, 44). This natural levee demonstrates a fixed position and a constant vertical accretion during the time span between 5.000 BP and 2.500 BP [186] (PAEPE and BAETEMAN 1978, 44).

The B-system is characterized by green-brown medium sand, the top of which is situated around 30 m (PAEPE and BAETEMAN 1978, 42). Deposits of this system are widespread in the area of Tell ed-Dēr and Abū Ḥabbah in contrast to the more concentrated A-system deposits (PAEPE and BAETEMAN 1978, 42). The lithological units of the B-system are not uniformly composed of sandy material but reveal an alternating pattern of sand and clay layers with numerous small gullies [187] (PAEPE and BAETEMAN 1978, 42). The depositional environmental context [188] of these units, according to the authors, is one of an increased rate of accretion in an open landscape corresponding to a period of intense submergence [189] with short periods of emergence in between (PAEPE and BAETEMAN 1978, 42, 43).

Finally, the investigators identified a C-system consisting of brown to green-brown, medium to fine sand units at a depth of 1 to 2 m below the surface of the highest parts of the plain (PAEPE and BAETEMAN 1978, 43). Again this system displays a more concentrated channel pattern ... *superimposing in many places the pattern of the lower-lying A-system* (PAEPE and BAETEMAN 1978, 43). An important period of erosion preceded this system, [190] and after the C-system ...*the crevasse-system disappeared, flood-patterns became reduced in size and continued to bevel up in their own deposits* (PAEPE and BAETEMAN 1978, 44).

More research on the historical geography of the Tell ed-Dēr and Abū Ḥabbah region was done by GASCHE and DE MEYER (1980). Based on aerial photo interpretation, they

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system herein). Note that such a crevasse is on the same order of magnitude as those that can be identified with the present Tigris (see Figure 2).

[186] According to PAEPE and BAETEMAN (1978, 44), these channels continued to function from at least the end of the Atlantic until the early Sub-Atlantic. This corresponds roughly with the time-span from the Uruk to the Neo-Babylonian. GASCHE (1988, 43) came to the same conclusion, based on vertical flood plain accretion interpretations.

[187] In the augering profiles given by PAEPE and BAETEMAN (1978, Fig. 1), these sandy gullies are displayed as sand-containing lenses ('B-sands') with a local maximum thickness of 3 m.

[188] PAEPE and BAETEMAN (1978, 43) describe this general context for all three systems as *a pattern of a crevasse-system in a deltaic sedimentation belt*. As mentioned before, we prefer to use the term 'deltaic' in a stricter sense.

[189] Inferred from the deposits at Tell ed-Dēr associated with the so-called Palaeo-Babylonian floods and coinciding with the building of flood-protection dikes around Abū Ḥabbah and Tell ed-Dēr (PAEPE *et al.* 1978). This B-system probably continued to exist until about 3.000 BP (PAEPE and BAETEMAN 1978, 43).

[190] Inferred from deposits at Tell ed-Dēr, this system is associated with post Neo-Babylonian floods (2.500 BP to 1.650 BP) (PAEPE and BAETEMAN 1978, 44, and PAEPE *et al.* 1978, 32).

presented a much more detailed picture of the archaeological landscape for the study area, mapping the old irrigation canals, the archaeological sites, and traces of fossil meanders, [191] and bringing them into relation with two natural levee systems, the so-called X and Y levees (GASCHE and DE MEYER 1980, Plan 1). Here, all these relations are clearly expressed better by their 'levee system X' of Tell ed-Dēr and Abū Ḥabbah (GASCHE and DE MEYER 1980, 10). As was evident from the general pattern of the old irrigation canals along this levee, the direction of flow between these two sites must have been from southwest to northeast, at least during the last stages of its development. Furthermore, GASCHE and DE MEYER (1980, 9, Fig. 4 and 5) demonstrated that the fossil meanders between these two sites that are visible on the aerial photos coincided with the meandering watercourse labeled on the late 19th century AD 'Bewsher' map [192] as the Nahr Malcha (= Nahr al-Malik), already described above. More than 75 % of the archaeological sites are located along these two natural levees (X and Y) and, according to GASCHE and DE MEYER (1980, 12), an important percentage of them are from the Parthian-Sasanian or early Islamic period.

Of particular interest is the contribution of BAETEMAN (1980), especially her identification of two of these fossil meanders as point bar deposits, and her cross-sectional description of an old irrigation canal or argub.

She made an auger transect through the fossil meander south of Tell ed-Dēr, where she could identify a uniform, fining upwards (gravelly to silty clay) sandy lens of 5 m thickness and of nearly 300 m width. In the upper part of the section are interbedded lenticular silty clay layers (BAETEMAN 1980, Fig. 2). She interpreted these as point bar deposits of a rather important river. [193] A second fossil meander, east of Tell ed-Dēr, but now exposed in an open profile section [194] and of similar dimensions, was also identified as a point bar (BAETEMAN 1980, 20).

As mentioned already above, argubs consist of two parallel earthen walls or spoil banks, enclosing a central canal with off-takes near a main (feeding) channel. In the cross-section of one such old irrigation canal, she found the bottom of this former central canal to be situated 3 m under flood plain surface, with the spoil banks lying on top of these flood plain deposits (BAETEMAN 1980, 17).

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[191] This remains the base map. It is represented as background in Figure 14. The aerial photos dated from the 1970s.

[192] This map displays an abandoned meandering watercourse, situated on the summit of the main levee of our study area but still filled with water and connected with irrigation canals upstream. On earlier maps (CHESNEY 1850, map VII), but of the same century, the same traces are mapped but are shown partly as dry watercourses. It is possible that this watercourse was still used sporadically as an inundation or flood canal, partly diverting Euphrates high flood waters into the Tigris. The filling up of this watercourse must have occurred gradually, and it probably became totally inactive during the last century.

[193] In comparison with the present point bar deposits of the Twin Rivers, however, such dimensions are rather minor. In view of the existence of the abandoned watercourse on the Bewsher map, some of these deposits must also be interpreted as the latest channel fills.

[194] Due to non-natural accumulation, it was impossible to distinguish any sedimentary structures (BAETEMAN 1980, 20).

Fig. 14. Present Topography of the Study Area Showing the Localization of the Auger Transect. Indicated as background are the old irrigation canals and tells as identified by Gasche based on aerial photos of the 1970s. Indicated as well are the main modern canals and drains and the fossil meanders. These are well preserved on the top convexity of the natural levee between Tell ed-Dēr (57) and Abū Ḥabbah (58). See text for further details. Localization of samples for granulometric analyses ③ = AQ PA (see Figure 12) and ④ = C24 ; ⑤ = fm ed-Dēr point bar deposits (see Figure 17). Numbered sites refer to site survey catalogue numbers of Adams 1972.

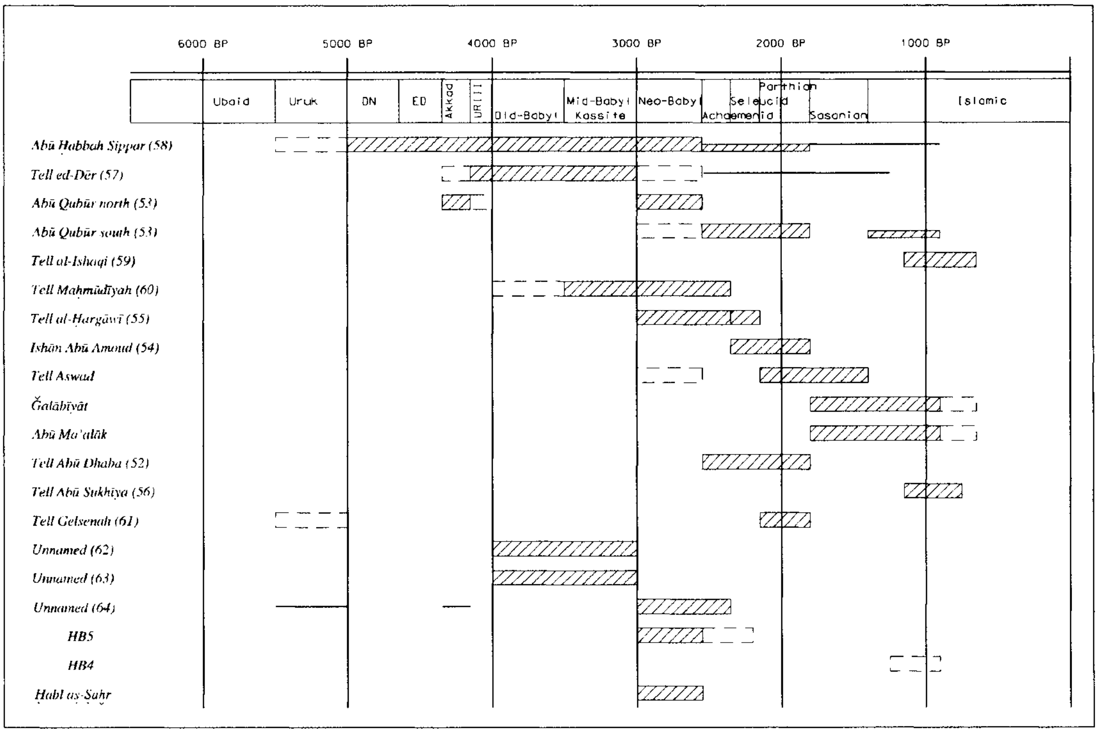

Fig. 14b. Settlement Occupation Histories of the Study Area. Reference numbers refer to site survey catalogue numbers of ADAMS 1972. See Figure 14 for localization. Based on various sources.

Such a configuration, with spoil banks that are not interwoven with or partly buried by the vertical accretion activity of the flood plain, suggests that there was no net vertical accretion of the natural levee at all during or after the functioning of this argub system and that this configuration depicts the latest functional phase of the argub. Since some of the off-takes of these old irrigation canals are still clearly situated on the concave side of fossil river meanders (the preferential side for water capture), one might get the impression of a frozen landscape of disused irrigation canals [195] after the (sudden ?) abandonment of the main feeder watercourse (canal) on the topographical levee.

Our study area was placed in a broader archaeo-geographical context of the northern part of the Mesopotamian plain by GASCHE (1985). He suggests that this region was irrigated by at least three different branches of the Euphrates during the third and second millennia BC (GASCHE 1985, 583). Here, the other topographical levees, most of which are situated north of the levee X, were interpreted as irrigation levees, and other probable fossil meander traces not associated with topographical levees were mapped.

Extrapolations on vertical flood basin and levee accretions were done by GASCHE (1988, 42) for the natural levee X under consideration. According to him, this levee was

[195] The dating of such old irrigation canals forms a *terminus post quem* of the abandonment of the feeder watercourse.

certainly a net-vertical-accretion natural levee from the end of the 4th millennium BC onwards, but stopped flooding [196] before the 6th century BC. The watercourse on this levee still existed later, but it was not clear to him at the time if its regime was natural or man-controlled (GASCHE 1988, 43). Cole and Gasche now suggest that its regime was probably no longer natural after c. 900 BC (see p. 32, this volume).

The present fieldwork was planned to provide a general flood basin and levee transect in order to gain some insight into the evolution of the flood plain in general and the ancient natural levee in particular.

7. 2. Definitions and Model Morphology for Meandering and Anastomosing River Systems in a Flood Plain Context

7. 2.1. Definitions

River system and flood plain morphology is well understood and the main concepts were already briefly summarized above at meso-scale. Many excellent textbooks are available, along with hydrographic studies dealing with the hydraulics and morphometric aspects of river systems at micro-scale, as well as with their sedimentology.[197] Most of these employ an idealized, abstract model of the different river morphological systems. The models we have employed are illustrated below in Figures 15 and 16. The understanding of the field data and the augering interpretation is projected on this idealized model. To facilitate communication we found it relevant to present this model morphology of a meandering river at micro-scale here, as well as some general definitions which we will use furtheron in this article.

The flow regime of a river is here understood as a range of hydrological or water energies characterized by particular flow conditions which transport sediment in a specific way and that results in distinctive sedimentary structures and sequences characteristic of the flow regime.

Sedimentary structures are the patterns formed by sediments as they are deposited. They include ripples, cross beds, laminations, load casts, etc., and are associated with the flow regime concept. Sedimentary structures usually refer to the internal structures of a depositional unit and are associated with typical bed forms (structures forming on the floor of a flow regime). Such structures can only be interpreted adequately in profile sections. Augering with a screw-auger of course does not permit a description of sedimentary structures because of the disturbance. It should be repeated here that the lack of profile section descriptions is a big handicap for interpreting sedimentary environments.

Sedimentary sequences are vertical successions of sedimentary structures representing changing flow regime conditions through time. Well known sequences are the L-bar/T-bar

196 Therefore, the process of natural levee accretion and flood basin accretion must have stopped too.

197 ALLEN 1970; REINECK *et al* 1973; READING 1986; BOGGS 1987; COLLINSON 1989.

sequences of braided rivers and the point bar sequences of meandering rivers (FICHTER 1993, 62).

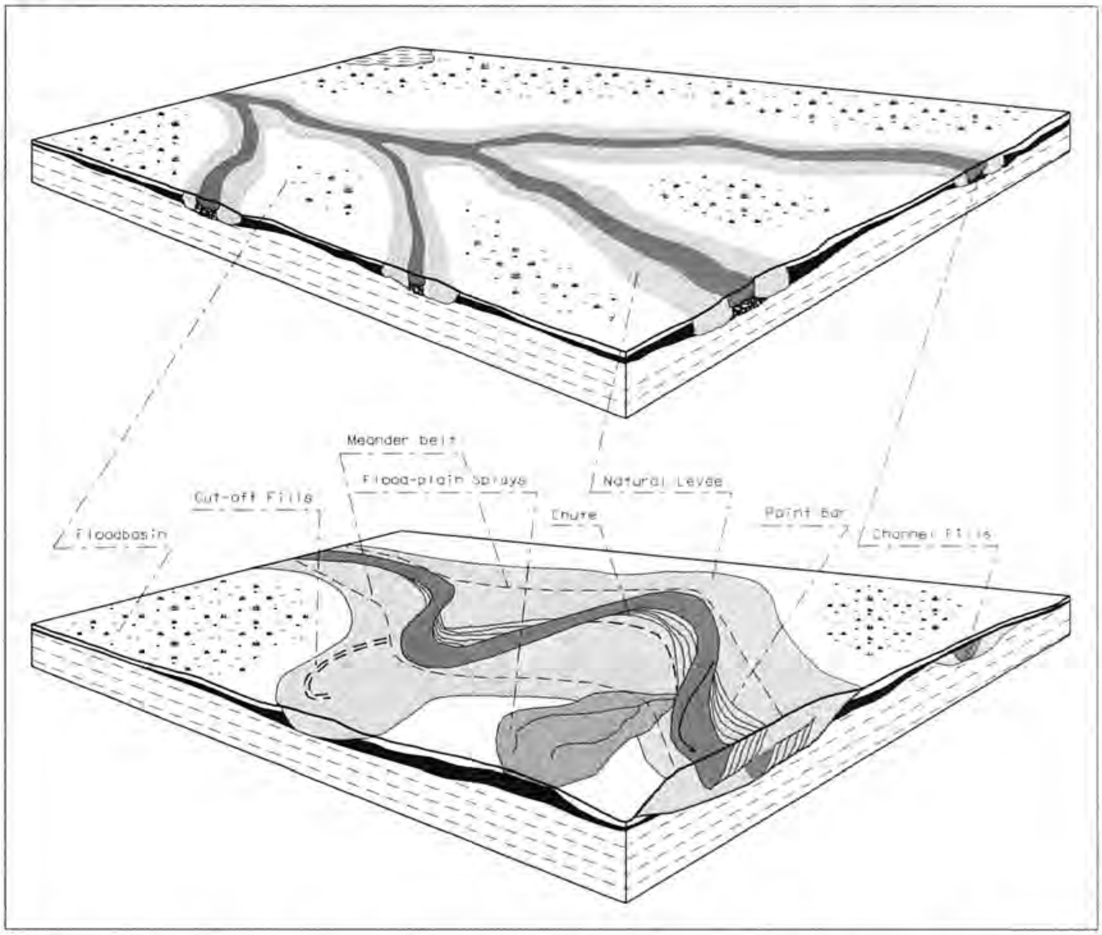

Fig. 15. Model of an Anastomosing and Meandering River (modified after READING 1986, 33 and BROWN 1997, 22).

Coarsening Upward Sequence (CUS) is a sequence of strata in which overall grain size increases up-section. This is opposite to a Fining-Upward Sequence (FUS), which shows an overall decrease in grain size up-section. A FUS (and CUS) usually refers to an overall upward decrease (or increase in the case of CUS) in grain size through many depositional units or events and is associated with the sorting power of a characteristic flow regime. The term 'graded bedding' refers to a type of bedding, usually one depositional unit, in which grain size changes gradually and progressively from bottom to top. Grading may be normal when grain size decreases upward, or reversed when grain size increases upward (FICHTER 1993, 218).

Crossbedding is the internal structure of a layer of sediment which was deposited at an angle to the horizon, or to the primary surface of sedimentation.

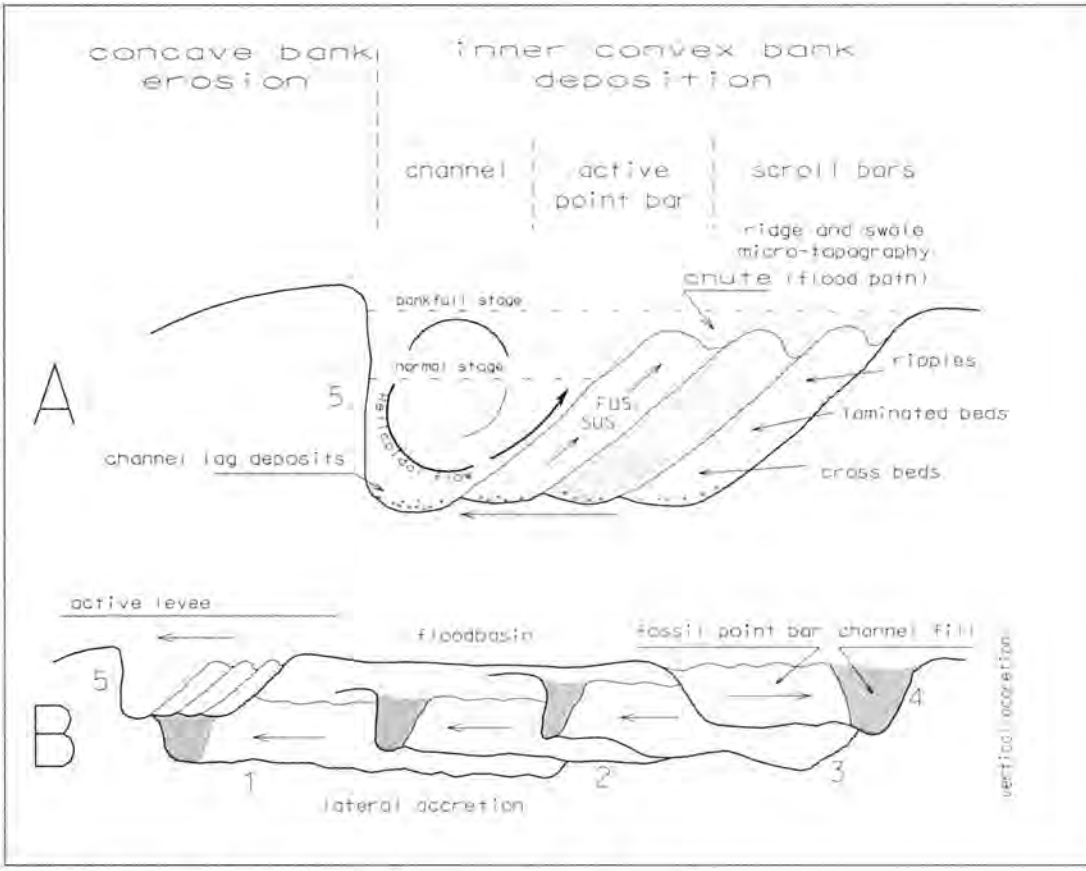

Fig. 16. Ideal Point Bar Sequence (modified after PETTIJOHN *et al.* 1987, 358).

7.2.2. Model Morphology and Processes

Fine clastic sediments are usually associated with a low energy flow regime, coarse clastic sediments with a high energy flow regime. A stable flow regime usually results in good sorting of the sediments, whereas an unstable flow regime usually gives poorly sorted sediments.[198] Abrupt textural changes might give an indication of an erosional base.

Meandering rivers show a more organized distribution of channel processes and sedimentation and a clearer separation of channel and overbank environments than do braided or anastomosing rivers. Although anastomosing rivers can develop levees as well, their channel patterns are generally more stable and less meandering. Therefore, meandering rivers display a meander belt with a higher dynamic in their erosional/depositional behavior (Figures 2, 6 and 7).

Characteristic of meandering rivers are the point bar deposits (Figure 16). These are sediment bodies enclosed by a meander loop. These bodies can be several meters thick.

[198] Sorting of the sand fractions or higher can be visually estimated in an auger core.

Point bars are deposited on the channel lag deposits of the meandering river, the texture of which ranges from medium-to-fine sand to silt. Typical sedimentary structures of point bars are climbing ripples on top and small trough cross beds below (FICHTER 1993, 61).

Most scholars consider the helicoidal circulation in the meander bends to be the most dominant factor in the sedimentation processes of these point bars. These helicoidal flows show a surface component toward the outer bank and a bottom component toward the inner bank. The maximum velocities occur near the outer bank. The inner convex bank is the site of deposition, and the outer concave bank is the site of erosion (READING 1986, 32).

Thus the helicoidal flow moves toward the outer bank near the stream surface and toward the inner bank at the bottom. This helicoidal flow is responsible for the fining-upward sequence and the upward increasing sorting of the grains in the point bar units. Both granulometric parameters are diagnostic of point bar sediments.

The upper surfaces of point bars show a series of roughly concentric ridges and swales representing successive scroll bar accretions. The channel as a whole migrates transversely to the flow, depositing a unit of sediment by lateral accretion. The point bar deposits migrate downstream.

Deposition on point bars is the major process of sedimentation in meandering river channels. In ancient records point bar deposits and flood-plain splays constituted the major part of the fluvial sequence.

Typical for point bar deposits are their vertical, fining-upward sequence and upward sorting of the sediments. The basal contact of the channel bed is sharp with lag gravels. An idealized point bar sequence shows a fining-upward texture going from coarse-grained, massive, and crossbedded basal beds to finer grained, horizontally laminated beds. Figure 16, adapted from PETTIJOHN *et al.* (1987, 358), illustrates these general characteristics.

Shape, size, and sorting of the river sediments depend on the flow regime. In large rivers point bars are composed of scroll-shaped ridges (scroll bars) alternating with depressions (swales). Swales are filled with fine-grained muddy sediments ; even marshes may develop in them. The point bar deposits are built up by the coarsest suspension load and bed load sediments available in the stream. The coarse sediments of the point bar are deposited on the very coarse sediments of the channel lag.

The diagnostic characteristic of granulometric analyses of point bar sediments is that grain size decreases upward in a point bar sequence. The individual units of a point bar sequence are discontinuous and lenticular in shape. Point bar deposits may show accumulation of drifted plant material, freshwater mollusks, mud pebbles, etc.

A second diagnostic characteristic is the upward sorting of the sediments in the point bar. Sorting in general improves upward, but in some cases a decrease in sorting is apparent (READING 1986, 36). Sand is moderately to well sorted.

We can conclude that the upward decrease in grain size and the improvement of sorting are general characteristics of point bar deposits. Granulometric analysis of samples

taken from Auger C 24 (see Figure 14 for localization) illustrates these depositional characteristics. The probability graphs are illustrated in Figure 17.

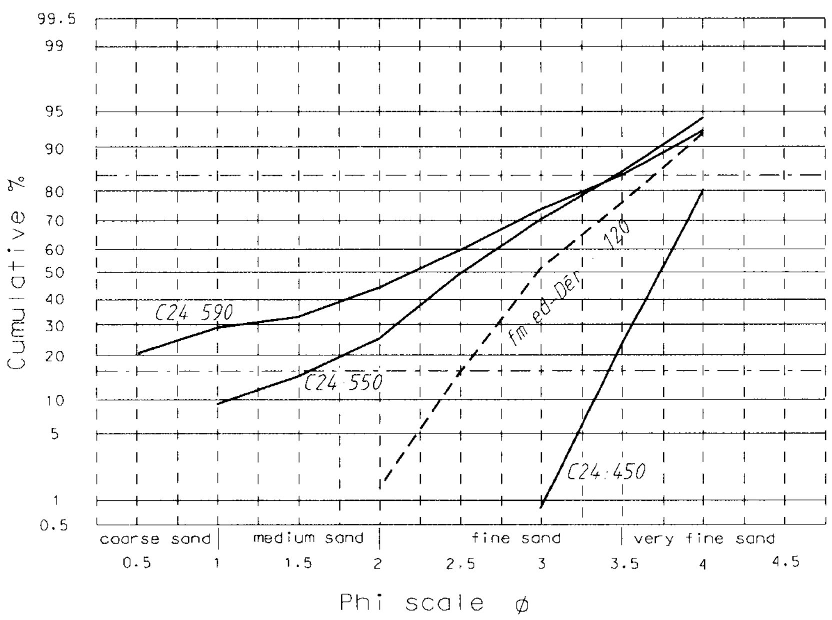

Fig. 17. Probability Graphs of Sand Fraction of Sample C24 (Point Bar Deposit) at Depths of 450, 550 and 590 cm Showing the Upward Sorting and Decrease in Grain Size. Sample fm ed-Dēr, taken at depth 120m in the fossil meander east of Tell ed-Dēr . For localization of samples see Figure 14. C24 :450 is very well sorted, very fine sand ; C24 :550 is moderately sorted, fine sand and C24 :590 is poorly sorted, fine to medium sand.

7.3. The Field Work

7.3.1. The Auger Transect

During the field work a NNE-SSW transect of approximately 25 km was followed perpendicular to an old river levee of the Euphrates.[199] The general location of the transect is shown in Figure 14. The transect starts at the present river bank of the Euphrates, cuts the ancient river levee, and ends in the flood basin depression north of the Baghdad-Baṣra highway.

[199] In fact the auger transect cuts three levee systems, the so-called levees X and Y and the present levee of the Euphrates. See e.g. GASCHE and DE MEYER 1980, Plan 1, GASCHE 1985, 581, or GASCHE 1988, 46, Fig. 2 for the geographical settings of the levee systems X and Y. Here the arbitrarily labeled *old river levee*, corresponds with the levee X, along which the sites Abū Ḥabbah and Tell ed-Dēr are situated. As will be discussed below, this old river levee is more pronounced in the auger transect than is the levee Y. It is thought that levee X is associated with the oldest branch of the Euphrates in its westward avulsive shift towards the Western Plateau. However, the chronology of these levees remains unresolved since there are no radiometric data available (GASCHE 1988, 41). Furthermore, river channels may reoccupy old abandoned channels (BROWN 1997, 69).

Due to the lack of adequate maps in the field, it was difficult to locate the bore-holes exactly. However, with the aid of a SPOT panchromatic satellite image (spatial resolution 10 x 10 m) in combination with the landscape description, where irrigation and drainage canals provide excellent orientation points, it was possible to remap the augering points within an acceptable margin of error.

The exact location of the auger transect was selected on the basis of the accessibility and need to find as many undisturbed landscape units as possible.[200] Other constraints were, of course, the perpendicular orientation to the presumed river levee and the need to make as continuous a transect as possible.

Due to the lack of topographical reference points and the long distance, it was not possible to level all the augering points absolutely. However, some sets of bore-holes could be leveled relative to one another. These relatively leveled augerings have been indicated with the same capital letter in the augering reference number or connected by a solid line in the profile figures. The height differences between non-leveled augering points are estimated only approximately on topographical one-meter contour maps, and are within a margin of error of less than a meter. No leveling was done at all for the transect on the present levee.

The augering was carried out with a screw-type (dutch) auger. The mean augering depth was about 5 m. In the field a general description of the augering spot was given and most of the following major characteristics of the different augering cores were described: texture (according to USDA; the sand fraction was estimated with a sand lineal) and (eventually) sorting class, soil matrix color [201] (Munsell revised standard soil color charts) and color mottling, consistency (rupture resistance, stickiness, plasticity), gley evidence (redoximorphic features), depth of groundwater table, presence of fauna [202] or flora relicts, evidence of gypsum or lime concentrations, evidence of salt, and abrupt textural changes.[203]

[200] The study area is of course a cultural landscape, and as mentioned above, the differentiation between natural and anthropogenic processes is extremely difficult to make. To give only one example, the Nahr al-Malik, probably situated on the old river levee, was cleared out several times: *Julian, following the example of his predecessor Trajan, caused the Nahr Malká to be cleared out, and the vessels were immediately floated into the Tigris* (CHESNEY 1850, 439). It is evident that a multi-disciplinary retrogressive landscape reconstruction is the most efficient approach to disentangle the making of this complex landscape.

[201] Color is perhaps the most obvious characteristic of a sediment but also the most difficult to interpret (FICHTER 1993, 216). However, in general the following interpretive criteria were followed in relation to the amount of oxygen present during deposition: black for deep and/or stagnant water (incl. decayed organic matter); gray/green (ferrous iron) for shallow and/or circulating water; brown/red/yellow(ferric iron) for terrestrial deposition.

[202] Usually only simply described by their status (fragments, condition), relative amount, and class as *Gastropoda* or *Pelecypoda* (Bivalvia). No samples were taken for more detailed determination during this reconnaissance survey.

[203] Although one can expect a general cut-and-fill fluvial history in flood plains, the transect did not reveal clear evidence of erosional boundaries like channel scours. Therefore the interpretation of abrupt textural changes was left open. It is the author's experience (or lack thereof) that, in the absence of profile sections, screw augerings have limited value for interpreting erosional features.

All these descriptive criteria, as well as the relative level of the augerings, were taken into account in defining and interpreting the sedimentary units, and in the inter-auger correlations and associations. By 'inter-augering correlations' we mean the grouping of similar deposits from the same sedimentary environments ; by 'associations' we mean the grouping of deposits which differ from one another but which belong to the same sedimentary environment.

The auger profiles were plotted and related to one another. Where it was not possible to correlate adjoining auger spots, some additional augerings in between were carried out. These additional augerings were not described to the same extent.

In total some 100 augerings were carried out for the transect. Only 45 augerings, which we believe are characteristic, are represented here in the plots, and only the textural changes are indicated.

7.3.2. General Description of the Auger Transect

In general the following landform units along the auger transect were used for dividing up the transect. The three subdivisions will be described below in more detail :

- The transect on the flood basin (Figure 18).
- The transect on the old river levee (Figure 19).
- The transect on the present levee (Figure 20).

7.3.2.1. Description of the Transect on the Flood Basin

Figure 18 shows a general overview of the textural changes of the auger descriptions for the flood basin transect.

The topography is significant, and the levee in the southern part of this transect is well pronounced. The transect descends toward the north into the flood basin depression. The height ranges from 34 m south of the Yūsufīyah canal to 29 m north of the highway. In general the texture gradually becomes heavier as one moves to the north as one might expected in a flood basin context, although the high textural variability in the deeper parts of some of the auger descriptions makes the inter-auger correlations and associations difficult to interpret. In this transect not a single potsherd or brick fragment was found in the deeper sections of the auger.

Notwithstanding this, the following main inter-auger correlations [204] could be differentiated :

1) Heavy Clay Complex of the Flood Basin Depression

This heavy clay complex is situated in the northern part of the profile and forms the lowest area of the dry, saline depression. This depression shows evidence of a long period of inundation and is covered by flood or fine textured irrigation deposits (Augerings 89/40, 38, 37).

General morphological description :

- saline surface layer (hygroscopic salts)
- grayish, yellow brown (10 YR 4/2 moist) and dull yellow orange (10 YR 6/3 dry) clay top layer with a mean depth of 1.60 m ; hard ; very few fine roots ; some fine, faint mottling ;
- brownish black (10 YR 3/2 moist) silty clay layer with a mean thickness of 25 cm ; hard ; few organic materials, few original plant forms recognizable to naked eye, organic material very dispersed ; former surface horizon.
- olive (5 Y 5/4 moist) sandy loam thin layer ; slightly sticky, plastic ; prominent gley layer (main thickness of 5 cm).
- olive (5 Y 5/4 moist) reduced clay layer, minimum thickness 1.50 m ; sticky, very plastic ; few shells ; max. depth of augering : 3.00 m.

2) Lenticular Sandy Body

North of Ḥabl aṣ-Ṣaḫr [205] a lenticular greenish, sandy deposit could be differentiated (Augerings 89/21,20). This body is situated at a mean depth of 3.5 m, has a minimum thickness of less than 1 m, and its horizontal extensions could be traced between augerings at a maximum distance of less than 200 m. Interpretation of the deposits is highly hypothetical. It is probably either an old minor channel branch or deposits of flood-plain splays. Auger 89/20 is clearly deflecting from the expected flood basin context since it contains a poorly sorted, gravelly sand layer. Its interpretation is open, but it can be viewed as reworked terrace material.

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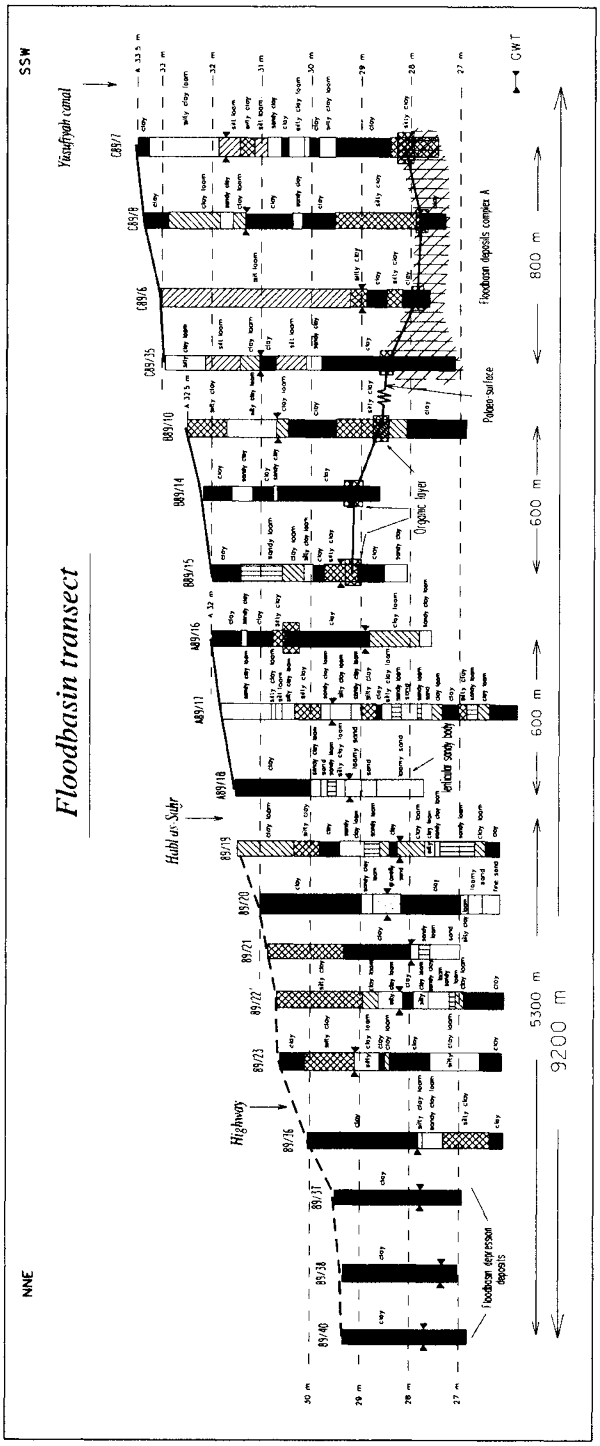
[204] Our description is perhaps biased and general, as expected flood basin augerings are underrepresented in the transect representation. However, our attention was focused on the reconstruction of the palaeo-fluviatile patterns and associated channel deposits. Description and interpretation should be separated here. However, since correlation always includes a kind of interpretation, it was thought necessary to include here some interpretations to facilitate communication. The reader can easily make the distinction.

[205] For a detailed description, location, and interpretation of the Ḥabl aṣ-Ṣaḫr (Nebuchadnezzar II's cross-country wall north of the natural levee), see BLACK *et al.* 1987. For its significance in the general morphological flood plain context, see GASCHE 1988.



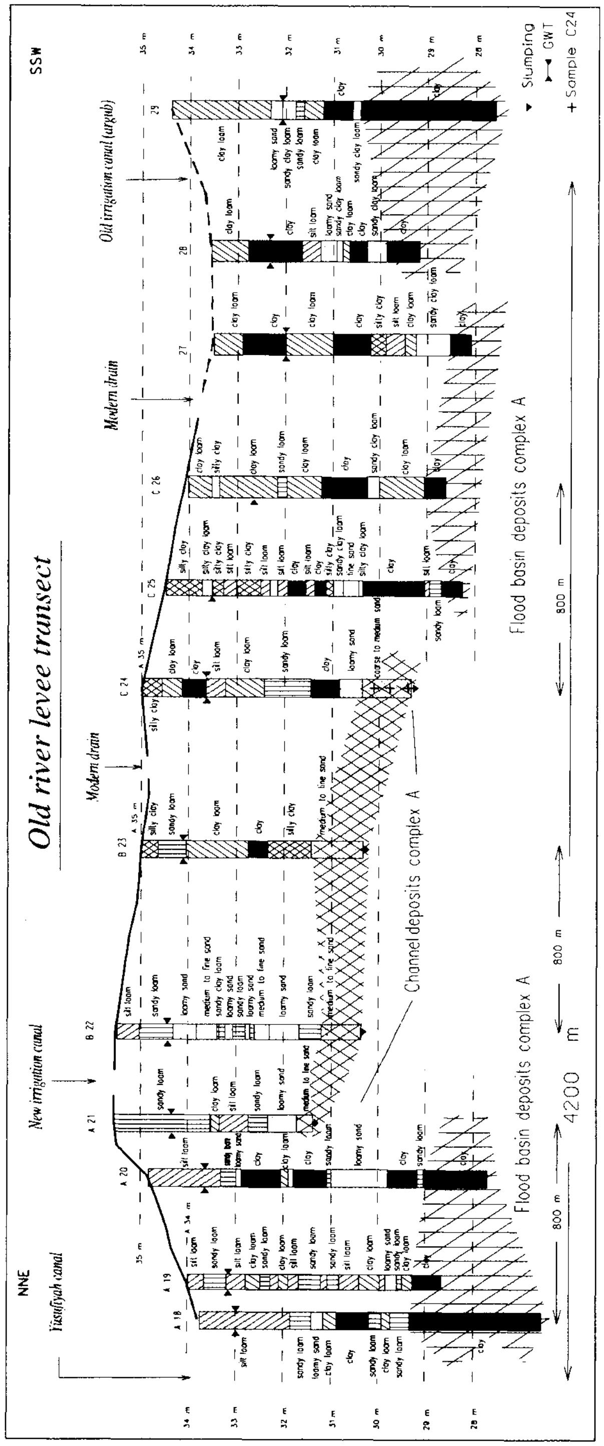


Fig. 18. Plot of the Flood Basin Auger Transect, Showing the Position of the Flood Basin Depression Deposits (Auger 89/40, 38, 37), the Lenticular Sandy Deposits (Auger 89/18), and the Flood Basin Deposits Complex A (Auger 89/35, 6, 8, 7). Also indicated is the organic layer on the top of the palaeo-surface. For localization see Figure 14.
Fig. 19. Plot of the Old River Levee Transect, Showing the Sandy Channel Deposits Complex A (Auger A 21, B 22, 23, C 24) and the Flood Basin Deposits Complex A.

3) Lenticular Sandy to Loamy Sandy Body

South of Ḥabl aṣ-Ṣaḫr a lenticular sandy to loamy-sandy deposit [206] could be differentiated (Augerings A89/18,17). This body is situated at a mean depth of 2 m, has a minimum thickness [207] of more than 2 m, and its horizontal extensions could be traced between augerings at a distance of less than 800 m. Few undetermined shell fragments are present in this better sorted unit. Interpretation of the deposits is highly hypothetical. It is probably either an old channel branch or deposits of flood plain splays. Auger A89/17 is clearly deflecting from the expected flood basin context and may be interpreted as bank deposits.

4) Flood Basin Deposits Complex A

This body represents the oldest flood basin deposits and is probably the substratum into which the old river scoured the channel. The body was recognizable along both sides of the old river levee (Figure 19). The thickness is at least 2 m.

General morphological description : olive brown (2.5 Y 4/3 moist) heavy clay to silty clay layer of unknown thickness at a mean height of 28.5 m ; sticky, plastic ; abundant shells and shell fragments of gastropoda and bivalves (*unio* sps.).

5) Palaeo-Surface

Perhaps the most interesting and spectacular finding of the auger transect was the discovery of a sharply contrasted clayey layer, relatively rich [208] in organic material at regular depth north of the Yūsufīyah canal. This layer is usually more than 10 cm thick. Vegetational remains in Mesopotamian flood plain sublayers are generally rare. Their status was partly well preserved, partly dispersed. This organic layer is arbitrarily called a palaeo-surface and could be followed as a reference plane at some distance. It is interpreted here as a synchronous boundary, gently sloping southwards. The term 'surface' is here interpreted as a more or less horizontal plane once at the surface, where inundations have occurred over a long period. This explains the reduced condition of the deposits and the partly good and partly dispersed preservation of the organic material, since the access of oxygen was probably prevented by a shallow water layer. The relatively good preservation of the organic material can probably also be attributed to higher sedimentation rates. The palaeo-surface is probably associated with the former backswamps of the old river. It is the only subsurface-unit in the transect that revealed evidence of organic remains.

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[206]. It is uncertain if this unit can be correlated with the thick sandy layer at two meters depth close to tell HB 5 (Nijs, 1987, 5).

[207] Lower boundary could not be determined due to slumping of the bore-holes.

[208] Roughly estimated at 15%.

7.3.2.2. Description of the Transect on the Old River Levee

The levee is topographically well pronounced and reaches its top convexity at the present location of the new irrigation canal.

In general the texture ranges from loamy sand to clay loam at the top of the levee. It gradually becomes heavier in both directions and coarser in depth. Figure 19 illustrates the textural changes of this transect. On the shoulders of this levee, the soil is highly saline.

We could differentiate the following units :

1) Channel Deposits Complex A

These deposits are green sandy to coarse sandy sediments deposited in the river channel itself as channel beds or point bar deposits. General description of the channel bed deposits are medium to fine sand with a greenish 5Y 6/4 (wet) color. Very few shells were found. The lowest levels of these deposits were never reached due to the slumping of the auger holes. They started at a depth of 31.5 m and could be followed for over 1.5 km. The sandy deposits become coarser toward the south, and granulometric analysis indicates that the texture within one augering hole shows a fining-upward sequence and better sorting (Figure 17). These channel deposits are most probably old point bar deposits with a lateral shifting of the channel bed deposits toward the north. As such these deposits represent natural river channel conditions

2) Flood Basin Deposits Complex A, South of New Irrigation Canal

These heavy clay deposits were found on both sides of the channel bed deposits complex A. They occur at a regular depth of 28.5 m. In Figure 19 these deposits probably also form the base of the palaeo-surface.

General description :

heavy clay to silty clay (2.5 YR 5/2 wet) ; unknown thickness ; very sticky ; common, fine, distinct mottling ; common, fine, distinct gypsum crystals ; few, abundant fine shell fragments.

These deposits are associated with the oldest flood basin deposits. Central are the channel deposits indicating the old river channel beds and point bar deposits (Augers 21 to 24). The width of these channel beds is about 1500 m. This is not a width of the same order as that of the present talweg of the Euphrates but it is on the same order of magnitude for point bar deposits. We can conclude that the location of the auger transect is not perpendicular to the stream line, or, most probably, that we have been augering in a large point bar deposit or meander belt of the old river.

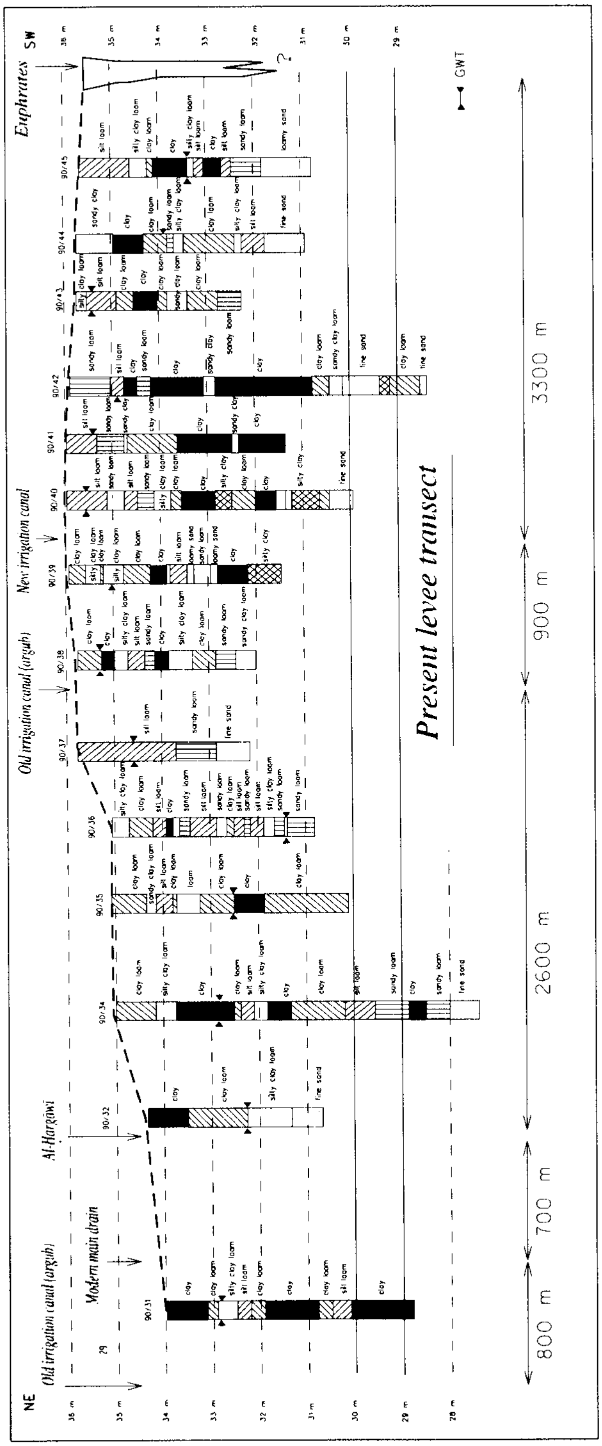

Fig. 20. Plot of the Present Levee Transect Showing the Present Euphrates and the Present Levee Deposits.

7.3.2.3. Description of the Transect on the Present River Levee

The transect of the present levee is illustrated in Figure 20. Here inter-auger correlations are very difficult to make due to the high textural variability of the sediments. This can be explained by a very active sedimentation environment. Generally this levee consists of silty loamy to clay loamy texture with lenticular deposits of heavy clay (Augers 40, 41 and 42). Topographically this present levee is situated at a slightly higher altitude than the old river levee. Morphologically the latter shows major dimensions and is better expressed in the augerings.

7.4. General Interpretation of the Transect (Fluvial Stratigraphy)

The general flood basin/old-levee/present-levee flood plain context, as indicated in the subdivision of the auger transect, is well expressed in both the general surperficial and subsurface textural changes in the horizontal direction of the transect

The Flood Basin Transect

The flood basin transect can, generally speaking, be further subdivided in a flood basin depression unit, north of Ḥabl aṣ-Ṣaḫr.[209] The top two meters of this unit consist mainly of clay and heavy clay deposits.

The area north of the modern highway is at present an uncultivated saline depression. However on DISP [210] of October 1965, this area was under cultivation and fed by secondary irrigation canals that took their water mainly from the Yūsufīyah Canal. In this area, two superimposed, clayey to heavy clayey sedimentary units can be differentiated with certainty, probably separated by a buried soil at a mean altitude of 27.5 m. The lowest unit probably consists of flood basin depression fillings, whereas the upper unit is mainly composed of irrigation sediments. This area is situated only 10 km south of the present Tigris meander belt. Presumably the flood basin depression fillings here are mixed flood sediments of both rivers. From the general pattern of the old irrigation canals, we can assume that most irrigation sediments are brought in by irrigation canals located on the north-facing slope of the old river levee.

The area between the modern highway and Ḥabl aṣ-Ṣaḫr exhibits in general clayey upper sediments, but not as uniform as the flood basin depression. This textural variability is more outspoken here in the deeper parts of the transect. The appearance of sandy lenses north of Ḥabl aṣ-Ṣaḫr below a mean altitude of 27.5 m, and sandy to even gravelly-sandy units at an altitude of 28.5 m, suggest a more complex depositional history than that expected during gradual vertical accretion in a low energy flood basin context. They can be

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209 Note that this area is indicated on the 'Bewsher' map as a swampy area, *covered with bivalve shells.*

210 Declassified Intelligence Satellite Photos.

interpreted as buried sediments, deposited in higher flow energy environments. Based on the poor sorting of the sand, we can exclude an eolian origin.[211]

With the presently available data, we will interpret these sandy lenses as deposits of former minor watercourses.[212] The sediments in the upper sections of the transect in this area are probably irrigation sediments.

South of Ḥabl aṣ-Ṣaḫr another sandy to loamy sandy unit can be distinghuised at a mean depth of 3 m (approx. 28.5 m altitude). This unit is finer in texture than the above-mentioned lenticular body north of Ḥabl aṣ-Ṣaḫr, but it is more pronounced in its horizontal dimensions. Again, with the presently available data, we will interpret this sandy lens as deposits of former watercourses but associated with a lower energy flow regime.[213] The upper units in this area are interpreted as later, high flood basin deposits.

The upper sediments, north of the present Yūsufīyah Canal and situated on the higher north-facing slope of the old river levee, contains more silty material and reflects the vertical accretion of overbank deposits of the old river levee. The organic layer is interpreted as a synchronic boundary (approximately at mean altitude of 28 m) and the substratum on which the overbank sediments were deposited. Beneath this layer older flood basin deposits are differentiated.

The Old River Levee Transect

The new irrigation canal of Yūsufīyah is situated on the top convexity of this old river levee of the Euphrates. The sediment units here can be interpreted as the vertical accretion of levee formation. The upper meters of this levee are probably the result of an irrigation levee formation. The texture becomes coarser with increasing depth. The lower boundary of the sandy channel deposits could not be reached due to slumping of the bore-holes. The sandy unit below an altitude of 31 m is interpreted as meander belt deposits of a natural channel and could be followed for over a distance of nearly 1.5 km. The deepest sandy layers in Auger C24 are interpreted as typical point bar deposits (Figure 17).

The coarser texture of channel deposits A may indicate a higher discharge and river competence than at present. The dimensions of the point bar deposits may indicate as well higher meander amplitudes. These channel deposits are interpreted as channel bed and point bar deposits of a now abandoned river or branch of the former Euphrates.

The upper sediments on the south-facing slope of the old river levee are interpreted as a vertical accretion of overbank deposits. The textural variability is high, and locally sandier layers can be interpreted as flood-plain splays. There is a gradual transition from these

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211 Throughout the whole auger transect, no eolian deposits were differentiated.

212 These could be local flood gullies, flood-plain splays, channels, or buried irrigation canals. It is not clear if the gravelly sandy lens, as represented in Auger 89/20, represents remains of buried reworked terrace material.

213 This interpretation is based only on the better sorting and presence of shell fragments.

overbank deposits towards the high flood basin area [214] of Tell al-Ḥargāwī. In the vicinity of this important tell, sandy layers could be differentiated at a mean altitude of 31 m. These deposits are interpreted here as buried channel deposits. The base of this tell could be determined to be at around 30 m, which perhaps suggests a much older occupation than is presently thought.[215]

The Present Levee Transect

South of Tell al-Ḥargāwī, the topography expresses the vertical accretion of the levee of the present Euphrates. It was thought that this transect would reveal channel deposits of a former branch of the Euphrates, flowing north of the terrace of Iskandarīyah. A greenish, well-sorted, fine sandy layer of minimum 200 m width that is represented in Auger 90/37 at a mean altitude of 32.5 m may be interpreted as such. However, they are not as well pronounced as in the old river transect.

In general the auger transect displays an extreme variability of textural changes, and it was impossible to make any correlations in the fluvial stratigraphy. Multi-spectral satellite imagery clearly shows different abandoned channel beds here, reflecting different stages of meander development. It certainly represents an area of high fluvial activity of the Euphrates, since its meander belt abuts against the desert area of the Western Plateau and the fluvial erosion terrace of Iskandarīyah.

7.5. Conclusions and General Working Hypothesis

Taking into account the limitations of an auger transect already outlined above, interpretations of the fluvial stratigraphy, and reconstructions of the sedimentary environmental and palaeo-flood plain based on the transect are hypothetical.

However, we believe that following general conclusions are possible.

The occurrence of sandy lenses and their topographical position in the present flood basin context indicate a multi-channel fluvial environment or anastomosing channel pattern. After the early-middle Holocene, this anastomosing pattern changed gradually towards a meandering pattern with a well pronounced meander belt formation of the old river.

The main cause for such a change in pattern may be found in the net aggradation of the fluvial system in this area, which in turn may be possibly due to the combined effect of downstream sea-level rise, upstream increase in sediment supply, and decreasing water discharge.[216] We can posit, based on the combination of our data, the archaeological

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214 Note that this area is indicated on the 'Bewsher' map as a swampy (Haur) area.

215 Unidentified pottery fragments were found in bore-holes in layers 3.5 to 4 m below plain level. This coincides approximately with 30 m altitude. It should be stressed that no leveling nor systematic augerings were done here. We believe however that the channel deposits in the vicinity of the tell can perhaps be correlated with its founding.

216 Aggradation is also favored by greater seasonality of the discharge.

evidence, and the documentary record (see Cole and Gasche this volume), that this transition was not completed until sometime between the late Old Babylonian period (at which time three natural river courses seem to have still been functioning in the Sippar region) [217] and c. 900 BC (by which time the main flow in the Euphrates system in this area had shifted westwards to the Araḫtu/Purattu line through Babylon).[218]

In the case of the old river levee, the channel deposits complex A represent deposits of a natural meander belt formation of the former Euphrates river. As indicated in the auger transect, the river channel deposits are very broad. This gives the impression of having augered into a huge meander with point bar deposits that were building up by lateral accretion toward the north. Granulometric analysis confirms this interpretation. The overlying deposits may be interpreted as irrigation levee deposits.

The channel sedimentation processes of the old river were responsible both for the building up of the point bar deposits and the lateral movement of the channel towards the north. We correlate the latest channel fill deposits with the irrigation levee sediments found in Auger B22.

On the left bank of the old river a well preserved organic layer could be interpreted as a palaeo-surface at around 28 m. The occurrence of the palaeo-surface indicates a stable period in the building up of the old river levee. A reducing environment, probably a back swamp of the levee, along the north side of the river channel, gives evidence of a long period of inundation. The flood basin deposits complex A is interpreted as the substratum into which the old river scoured its course. The loamy deposits which cover the palaeo-surface are interpreted as bank deposits of the old river system.

The topography of the palaeo-surface is significant. Its level increases toward the north, giving it the appearance of a lower lying depression in the south, where the old river-channel bed deposits occurred. The palaeo-surface is absent south of the canal of Yūsufīyah. It is not clear if this absence is due to the westward shifting of the old river toward the present Euphrates course or is due to erosion of later meander formation.

Due to the high textural variability on the present levee of the Euphrates it was difficult to separate the different sedimentological units. It certainly reflects a high intensity of fluvio-morphological processes which can be attributed to the natural flooding and shifting of the branch toward the present course. On this basis alone we can neither confirm nor deny the existence of a natural levee Y in this area. However, according to Cole and Gasche (this volume, p. 32), we know from the textual record that this was the approximate location of the main bed of the Euphrates by at least c. 900 BC, because the Assyrian king Tukulti-Ninurta II had to travel westward from Sippar for some distance before reaching this

[217] These are 1) the Irnina, 2) a channel that Cole and Gasche call the 'Main Branch of the Purattum' (= levee X), and 3) one they call the 'Kish Branch of the Purattum' (later the 'Upper Araḫtum'), for which see, e.g., their Map 8 in this volume.

[218] Without any evidence of another functioning natural channel at this time (see Cole and Gasche this volume, p. 32).

river, which was now called both Purattu and Araḫtu and was the main river through the capital, Babylon, downstream.[219]

The two most important archaeological sites of this study area, Tell ed-Dēr and Abū Ḥabbah, are both located on the same old river levee. Abū Ḥabbah, with its base at 28.5 m, was founded around 3.300 B.C., while Tell ed-Dēr, with its base at 29.5 m, was founded approximately 1.000 years later (GASCHE 1988, 42). Probably the foundation of these two sites must be situated in an anastomosing river environment with stable, vegetation-covered river banks.

In order to differentiate the main morphological and sedimentological units of the old river system, a detailed augering program was necessary. It gave the opportunity to identify both an old river course and a model of the river system of an old branch of the Euphrates. If similar conditions can be found at other spots, this model can be extrapolated.

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219 See Cole and Gasche this volume, p. 32.

* The abbreviations used here are those recommended in *Northern Akkad Project Reports* 8 (1993), 49-65.

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